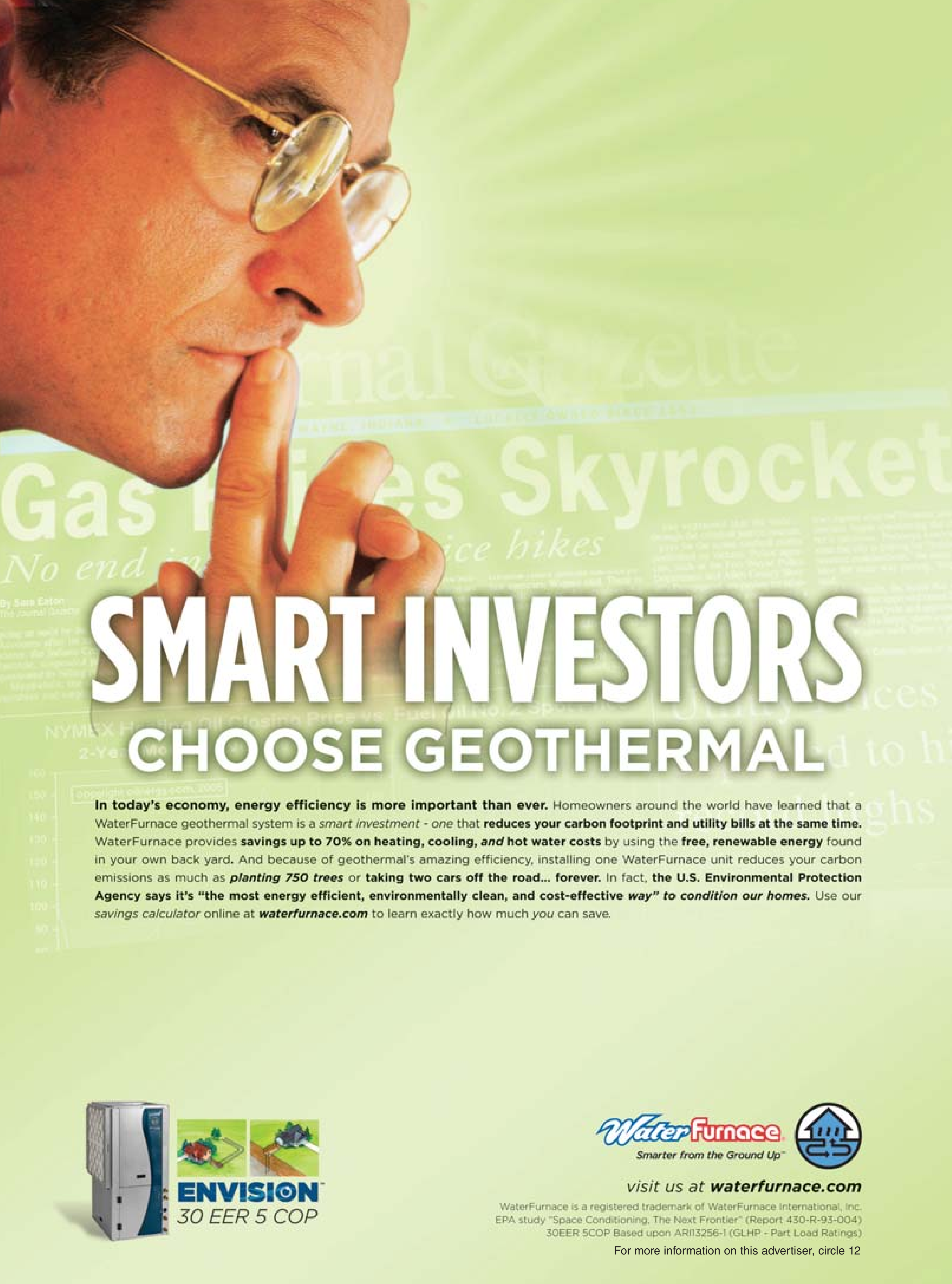

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MISSION STATEMENT

The mission of *Ultimate Home Design* is to serve as a catalyst for homeowners to create demand for architects, designers, and builders to adopt the concepts and building practices that define human-centered, optimum-performance home design. *Ultimate Home Design* is aimed at broadening the segment of the American population that is paying closer attention to the products they buy, looking beyond price and branding to focus on other elements of the production and value chain. Increasingly homeowners want to support sustainable building practices that result in a higher living standard. *Ultimate Home Design* is for those homeowners who want to promote a broader shift in patterns of production and consumption by encouraging practices that better reflect their personal values. We are advocates for using products that reduce energy and use renewable, recycled content or otherwise environmentally preferable materials. An important part of our mission is to promote building practices that result in a substantial reduction in energy use for space conditioning, water heating, lighting, and appliance operation. Another important aspect of our mission is to promote construction practices that improve the indoor environment and reduce the risk of building-related illness. This translates to improved occupant health and comfort by improving thermal comfort; natural lighting and electric illumination; and controlling humidity, odor, noise, and vibration.

Ultimate Home Design is for the thinking homeowner, who wants to be educated and learn about intelligent options for home design, whole-house system design, and comprehensive electronic lifestyle features that can enrich the quality of day-to-day life while reducing the cost of operating a home. With the knowledge gained reading *Ultimate Home Design*, you will be empowered to make intelligent choices about the design and make-up of your home, whether considering remodels or additions, planning a new home, or evaluating an already-built home. *Ultimate Home Design* will explore the wide range of possibilities within the context of designing Optimum Performance Homes™ that integrate universal design architecture; sustainable green building materials and techniques; energy-efficient power systems for electricity, lighting, heating, and air conditioning; water conservation techniques; and comprehensive electronic lifestyle features.

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WELCOME HOME
June 2008

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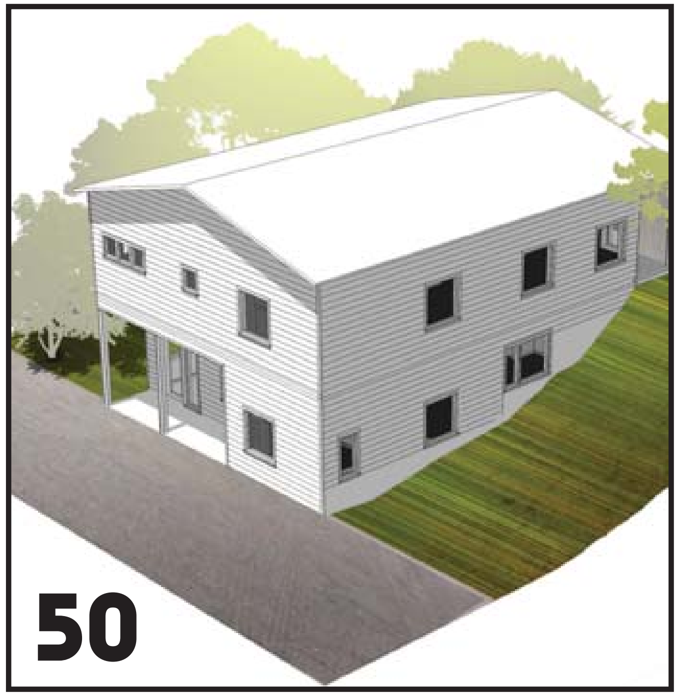

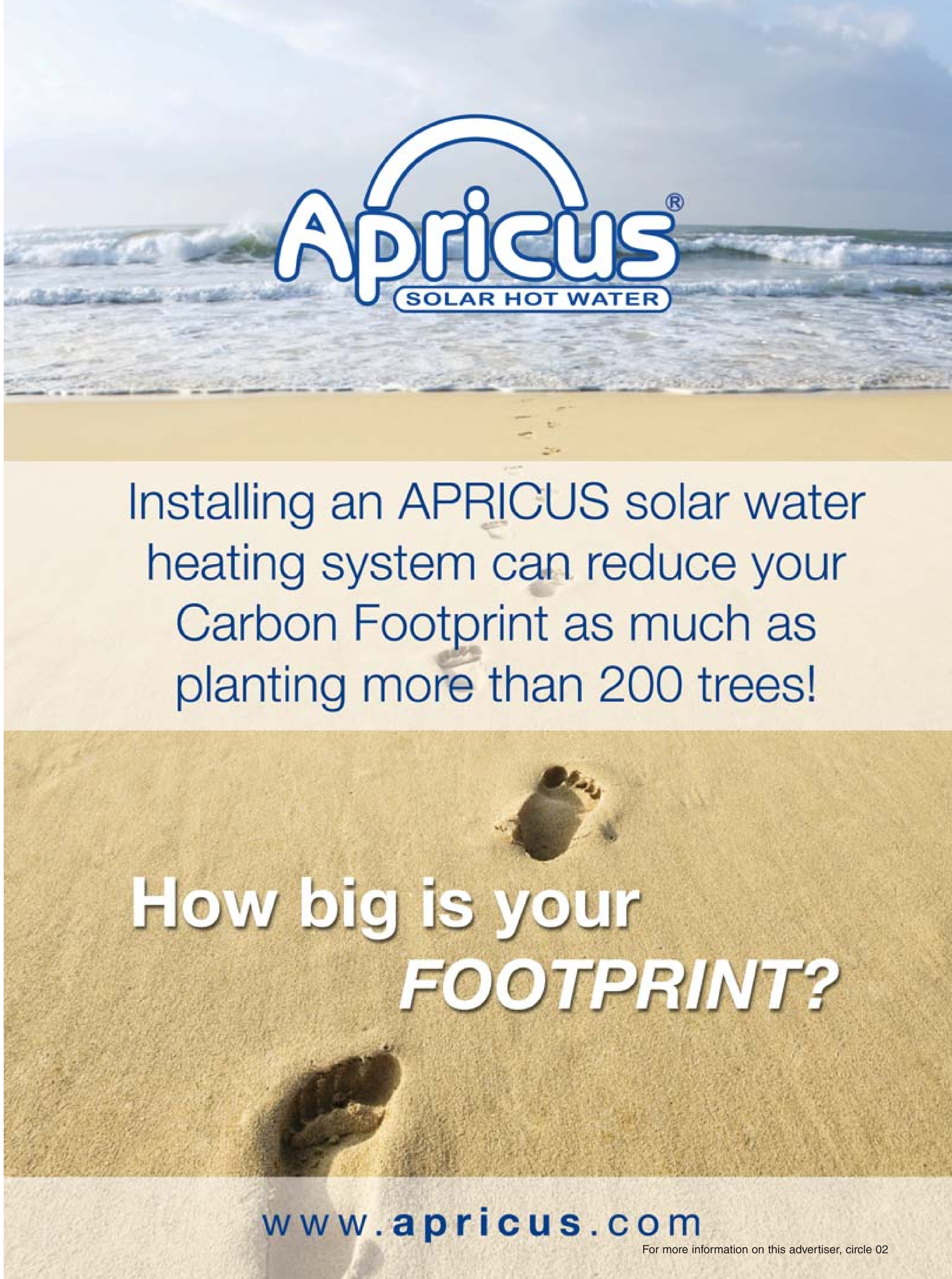

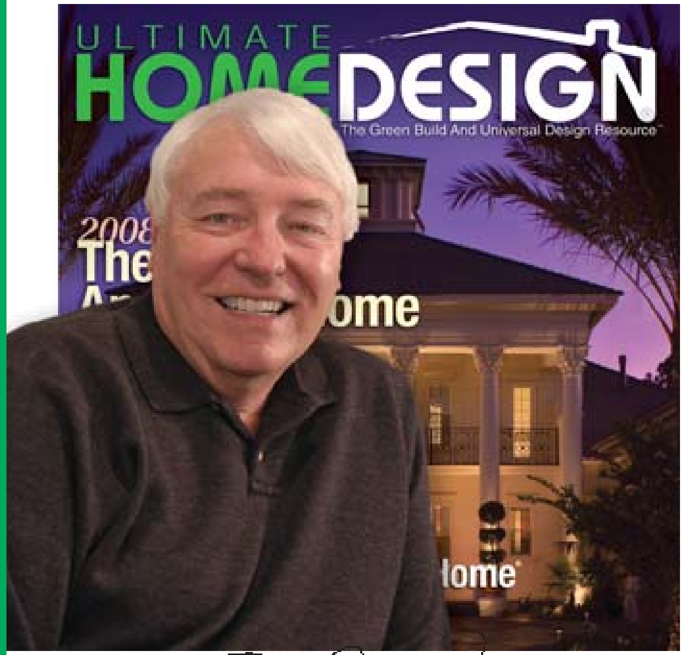

"Green" Building

Now that "green building" is an exploding market with an increasingly number of home builders adhering to or preparing to adhere to "green building" guidelines and standards, each issue of *Ultimate Home Design* will focus on actual new home projects that have been certified. The articles will be written by the owners of these homes or their architects. The projects will be those certified under the U.S. Green Building Council's (USGBC) LEED® (Leadership In Energy & Environmental Design) for Homes program, the newly launched National Association of Home Builders' National Green Building Program, and other programs.

The intent is to provide prospective "green" homeowners with insight into the design and construction of "green" homes, and to provide ideas to homeowners who intend to design and build their own homes.

The articles will also focus on universal design and biophilic design, as aspects of a holistic approach to home design that we advocate. While the LEED program stresses "Environmental Design" in its criteria, this element is limited to "landscape" and "interior air quality" environmental considerations. The program ignores the significance and importance of universal design, which is a design focus on the interior elements of the home and operational ease in day-to-day living in the home. Nor does the program directly address biophilic design, attributes of home design that connect occupants with nature and the natural environment to improve physical and psychological health. LEED is not alone in these design exclusions in the performance criteria required to achieve program certification. Thus, both universal design and biophilic design will continue to be critical platforms for coverage in *Ultimate Home Design*.

So-called "green" building is a new way to conceive home design, and as the articles will demonstrate, interpretation is varied. At this stage, homeowners cannot totally rely on architects or architectural designers, or builders or contractors, as knowledgeable and experienced in the practice of "green building." These professionals and trades are searching for answers as well, and their stories are valuable resources for moving forward, allowing our readers to better understand what their options are when it comes to engaging in their own projects.

In this issue of *Ultimate Home Design*, Part XV is the third article on the construction phase of the first Optimum Performance Home®, at The Sea Ranch, California. This in-depth article series provides comprehensive insight into what's involved in building your own "green" and sustainable, and "biophilic" and "universal" designed home. The documentation of the building of this LEED Platinum home is a work in progress, facilitated with construction site time-lapse high-definition images and streaming movies accessible through our Web site.

There are also other interesting and informative articles featured in the issue, including:

Doug Storey's article on "Building The First LEED Silver Certified Home in Massachusetts" conveys homeowner Margie Lynch's experience in defining and building a "green" home.

Susan Mack covers aspects of human-centered universal design in her article, "Universal Design Makes Life Easier For Everyone."

Heather West presents an article on Kolbe universal design window and door products entitled, "Kolbe Contributes Windows And Doors For An Accessible, Comfortable Model Home."

Korydon Smith, Jennifer Webb, and Brent Williams contribute an article on the "Universally Designed Proto-House," an Arkansas Ozark prototype home that works within the diverse social and physical contexts of the South.

The Center for Universal Design in the College of Design at North Carolina State University contributes an article on the feature list of elements, features, ideas, or concepts that contribute to, or can be components of, a universal designed home.

And Wally Dutcher tackles the question of "Is There An Optimum Approach To Incorporate Universal Design Principles When Designing A Home?"

Thank you for your support. This year continues to be remarkable, especially with our continuing coverage of the construction of the first Optimum Performance Home. UHD

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Breaking Ground

Recent News, Reviews, And FAQs

Issue 15, June 2008 Volume 3, Number 3

New Report On Methods For Calculating Solar Capacity

As utilities work to meet electricity demand, especially during peak summer days, examining the relationship between demand and solar photovoltaic (PV) output can be of significant value to the utility industry. Over the years, energy researchers have developed different statistical methods for calculating this relationship. However, there is no consensus across the utility or solar industries on a statistical method for calculating the capacity value of PV or its practical use in electricity markets and utility planning. The new report, Photovoltaic Capacity Valuation Methods, released today by the Solar Electric Power Association (SEPA) in consultation with project partners, and funded in part by the U.S. Department of Energy's Solar America Initiative, examines the variety of capacity calculation methods in use, and lays the foundation for building consensus within the solar industry, electric utility, and research communities. A complimentary copy of the full report can be downloaded from the SEPA Web site at http://tinyurl.com/43n4hl.

Utilities use a variety of means to plan and manage the electricity grid to meet consumer demand, traditionally by managing a dispatchable centralized generation and transmission grid. PV technologies have an intuitively positive relationship with peak electrical demand, even though their output can fluctuate–hot summer days with significant air-conditioning load are often the most productive for generating solar electricity. Despite this qualitative relationship, there isn't consensus on the most appropriate quantitative method or their use within the utility industry. "As the PV industry continues to grow rapidly in the United States, integrating renewable technologies into the utility grid management and economic valuation process is an important step in recognizing the value-added benefits that PV can contribute," stated Mike Taylor, SEPA's Director of Research.

The new research report catalogues the different methods in existence and provides standardized case studies to examine their relationship to one another at three locations across the United States: Nevada, New York, and Oregon. The more statistically advanced methods at a 5 percent PV penetration show a capacity value between 60 to 80 percent in Nevada, 40 to 60 percent in New York, and 10 to 25 percent in Oregon.

By developing an agreed upon framework for accurately and appropriately calculating photovoltaic capacity, and determining the risk of variation, a means will be provided for utilities and PV generators to innovate around the new economic propositions that will emerge from a recognized method. "This report represents the first step in an ongoing process between the utility and solar industries," according to Taylor. "Additional research areas and collaborative needs were identified that will be valuable in continuing this dialogue with the utility industry."

Photovoltaic Capacity Valuation Methods is the result of a yearlong effort that included the circulation of a white paper to utility and solar stakeholders, a workshop for these stakeholders, and subsequent discussions between the authors. This study was funded by the U.S. Department of Energy and by the Solar Electric Power Association. Authors included Tom Hoff, Clean Power Research; Richard Perez, State University of New York at Albany; JP Ross, Sungevity; and Mike Taylor, Solar Electric Power Association.

Top Home Builders On Environmental And Sustainable Practices

Despite some encouraging environmental and energy-efficiency developments in recent years, none of America's 13 largest publicly traded home builders have "fully embraced the emerging market of sustainable building design and construction," according to a major new study by Calvert—one of the nation's leaders in the field of sustainable and responsible investing—with support from the Boston College Institute for Responsible Investment.

However, Calvert found that KB Home, of Los Angeles, is "clearly leading the home building industry in terms of environmental sustainability," while four other home builders—K. Hovnanian, Red Bank, New Jersey; MDC Holdings, Denver, Colorado; Standard Pacific, Irvine, California; and last-place finisher NVR Inc., Reston, Virginia—are on what the report terms the "sustainability bottom rung." As the Calvert report explains: "The biggest challenge facing this group is that, for the most part, they have not acknowledged that there is a market for green homes or that they have a role in serving or promoting it."

For best-to-worst rated, the balance of the top 13 U.S. home builders are: tied for #2 D.R. Horton, Fort Worth, Texas; and Pulte, Bloomfield Hills, Michigan; #4 Centex, Dallas, Texas; #5 Lennar, Miami, Florida; #6 Ryland, Calabasas, California; #7 Beazer, Atlanta, Georgia; #8 Meritage, Scottsdale, Arizona; and #9 Toll Brothers, Horsham, Pennsylvania.

Entitled "Greener Pastures for America's Homebuilders? A Survey of Sustainable Practices by the Homebuilding Industry," the Calvert report concludes: "Our survey of the 13 largest publicly traded U.S. home builders finds that, while every major home builder has incorporated some environmental and efficiency programs and products into some of their new homes, none have fully embraced the emerging market of sustainable building design and construction. Calvert's study of the sustainable policies, programs, and performance of the nation's largest home builders revealed that the industry has a long way to go before any of the companies can truly claim to be addressing the risks and opportunities inherent in the environmental and climate change dilemmas."

Commenting on the report, Stu Dalheim, Director, Shareholder Advocacy, Calvert Group, said: "This is a real and growing issue for home buyers and for investors. As consumers become more educated about environmental options and green residential construction, and as regulators increase incentives for green development and restrict conventional development efforts, some home builders may be at a competitive disadvantage if they have not integrated sustainable design and construction principles into their construction. In the green building market, there is a first-mover advantage: Companies that make a concerted national effort to integrate sustainability into project sites, construction materials, and construction processes, as well as to provide energy, water, and habitat conservation options in finished products, will be able to build a brand image as the environmental choice for home construction. This brand will help environmentally conscious consumers make their selection of a home builder."

David Wood, Director, Boston College Institute for Responsible Investment, said: "Calvert's efforts to identify and benchmark best practices in sustainable home building are a leading indicator of how sustainability is likely to be integrated into investment analysis of the home building sector in coming years."

Other Key Findings

"Many of the companies had strong regional programs for environmental responsibility. However, while some of these programs have had significant results (Pulte and KB each has built over 15,000 ENERGY STAR® homes), the major builders offer few of these environmental options nationwide."

Many publicly traded home builders have committed to ambitious goals in energy efficiency, suggesting that major home builders' attitudes toward green building might be changing. In fact, 12 of the 13 largest home builders have now committed to building 100 percent ENERGY STAR homes in certain markets. However, as of the publication of this report, no major home builder has publicly committed to environmental responsibility as a core business strategy.

NVR Inc., Standard Pacific, MDC Holdings, and K. Hovnanian—the lowest-ranked builders "make virtually no mention of the environment on their Web sites or in other reports and have few programs to mitigate their environmental impacts. Not surprisingly, they lag behind the rest of the field in developing green homes. They are not very involved in the Building America program, are near the bottom in ENERGY STAR, and have not been engaged in other green building efforts. These companies may score lower because they are simply not public with their environmental goals or neglect to report their environmental successes."

The survey of the 13 largest publicly traded U.S. home builders used four major "green" indicators: energy use, building-material use, water use, and land use.

As an investor, Calvert seeks to discern how major U.S. home builders compare on policies, programs, and performance relating to the environment and resource efficiency. Despite the slump in the overall housing market, the green building industry is seeing annual growth of as much as 30 percent. Green building features for new homes present a clear opportunity for the home building industry; homeowners are willing to pay a premium for greener and cleaner homes of $18,500 on average, according to a McGraw Hill Constructions 2006 report, "Home Preferences of Green HomeBuyers: The Survey Says."

For more information about Calvert or this report, visit www.calvert.com or phone 301 951 4800.

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Green Home Building Market Has "Tipped" And Is Expected To Double By 2012

McGraw-Hill Construction, a part of The McGraw-Hill Companies, has reported the findings of its latest market research investigating "green" home building, focusing on changes in "green" building activity between 2001 and 2007; the impact of the down market on "green" home building; opinions and preferences of builders for "green" materials and processes, and triggers and obstacles affecting "green" building expansion.

The major findings of the survey, which is co-sponsored by the National Association of Home Builders (NAHB), include:

- The residential "green" building market is expected to be worth $12 billion to $20 billion (6 to 10 percent of the market) this year.
- In five years (2012), the market is expected to double to 12 to 20 percent market share, or $40 billion to $70 billion.
- 40 percent of builders think "green" building helps them market their homes in a down market.
- Quality has emerged in this down market as the most important reason for building "green." Previously, builders were motivated by energy cost savings of "green" homes and doing the right thing, which still came in No. 2 this year. This is likely due to "green" home marketing and how it improves quality of life.

"We have hit the tipping point for builders going green," said Harvey M. Bernstein, McGraw-Hill Construction Vice President of Industry Analytics, Alliances and Strategic Initiatives. "This year, the number of builders who are moderately "green"—those with 30 percent "green" projects—has surpassed those with a low share of "green"—those who are "green" in less than 15 percent of their projects. Next year, we will see even greater growth, with highly "green" builders—those with 60 percent "green" projects—surpassing those with a low share of "green." This year has seen an 8 percent jump over last year, and we expect another 10 percent increase next year."

"It's official. 'Green' has gone mainstream," said Ray Tonjes, chair of the Green Building Subcommittee for NAHB. "And now, the NAHB National Green Building Program is making it easier for home builders to provide sustainable, environmentally friendly homes for their customers. We're ready for the market transformation that McGraw-Hill Construction estimates."

The results, which were presented at the NAHB Green Building Conference will be incorporated into a new issue of the McGraw-Hill Construction SmartMarket Report series, available late June at www.analyticsstore.construction.com.

For more information on NAHB, visit www.nahb.org.

Third Edition Of *Green Building Products* Directory Released

BuildingGreen, the publisher of *Environmental Building News*, and co-publisher New Society Publishers, has released the third edition of *Green Building Products*, a product directory for home builders, remodelers, and homeowners. The new edition includes nearly 1,600 product listings from the GreenSpec® database of green building products, which BuildingGreen has maintained since 1998.

The third edition contains nearly 230 new listings, and many listings from the previous edition have been removed due to higher minimum environmental standards adopted by the editors.

"Each year the bar is raised with some of our product criteria to encourage change in the marketplace," said co-editor Alex Wilson. "As a result, some products get dropped, and better ones are introduced."

Green Building Products, which includes a foreword by architect and author Sarah Susanka, covers everything from porous paving systems to photovoltaic roofing shingles and top-efficiency appliances. Products are organized according to building component but can also be found in the index under manufacturer or product name. The book includes more than 250 product photos.

Products are selected for GreenSpec using criteria that *Environmental Building News* editors have developed over more than 15 years. These criteria include recycled content, Forest Stewardship Council (FSC)-certified wood, avoidance of toxic constituents, reduction of construction impacts, energy or water savings, and contributing to a safe, healthy indoor environment. The full list of criteria can be downloaded for free from the BuildingGreen Web site.

Manufacturers do not pay to have products included in GreenSpec or in *Green Building Products*. "We base selections on careful in-house review by our editorial staff," said Wilson. "Keeping an arm's-length relationship from manufacturers allows us to be non-biased when we are evaluating company claims," he said.

Green Building Products sells for $37.95 (plus shipping) and is available from *Ultimate Home Design* (ultimatehomedesign.com) at 888 977 7827. (BuildingGreen [www.BuildingGreen.com or 800-861-0954] and most book sellers.)

BuildingGreen has been providing the building industry with quality information on sustainable design and construction since its founding in 1985. The company's flagship publication, *Environmental Building News*, is the nation's oldest and one of the most trusted sources of information on green building practices, and their online BuildingGreen Suite is one of the most relied on Web resources in the building industry. For more information, visit www.BuildingGreen.com or phone 802 257 7300.

Whirlpool Corporation Joins The Bottled Water Debate

To some, bottled water offers convenience and a sense of clean water security. But, bottled is not necessarily better. Whirlpool Corporation, the world's leading manufacturer and marketer of major home appliances, seeks to educate consumers about clean drinking water—without the bottle. A refrigerator water filter can serve as the last line of defense against contaminants, but only if it is changed every six months.

Whirlpool brand would like to encourage consumers to refill reusable bottles with filtered water, right from the refrigerator. Last year, Americans purchased roughly 8.3 billion gallons of bottled water, at an estimated $11 billion, and then tossed more than 22 billion empty plastic bottles in the trash, according to the National Geographic Green Guide.

Filtered water is an effective way to get clean water at a lesser cost with reduced impact on the environment. NSF International, the leading organization for standards on consumer products, suggests that home water treatment systems can help provide protection against many contaminants like mercury and lead found in drinking water.

Consumers can find more information at www.whirlpool.com. There, they can also sign up for Whirlpool's filtration subscription service. Consumers will receive filters every six months right on their doorstep, and Whirlpool pays for the shipping.

Eagle Solar Roof Powered By Open Energy's SolarSave® Integrated Solutions

Open Energy Corp. has announced that sales of the Eagle Solar Roof are quickly gaining momentum nationwide. The Eagle Solar Roof powered by Open Energy's SolarSave® Integrated Solutions provides an environmentally sound and beautiful way for homeowners to save on their electricity costs.

Embraced by both homeowners and builders alike for its appearance and performance, the comprehensive solar roof solution is unlike anything previously available in the industry. The SolarSave panels of the Eagle Solar Roof are effectively installed alongside roof tile on the home, thereby maintaining the aesthetics and performance of a tile roof, while generating clean, safe, quiet energy from the sun. Since the SolarSave panels were designed to perform and be installed as a roofing product rather than a traditional solar panel, their durability is outstanding and warranted for 25 years as a roofing material and 25 years as a solar product. The solar panels also are lightweight, easily handled, and can be walked on, enabling roofing contractors and solar integrators to benefit from simplified installation.

According to Jay Banister, Eagle's National Green Program Manager, interest in the solar solution has been impressive from the very beginning, with sales quickly following. Officially launched in December 2007, the company has already provided the Eagle Solar Roof powered by SolarSave Integrated Solutions for installations on more than 125 homes and buildings. In addition, more than 40 presentations have been made to some of the nation's leading homebuilders interested in creating solar developments in Southern California.

The Eagle Solar Roof powered by SolarSave Integrated Solutions is now available in the following states.

California	Washington
Oregon	Idaho
Montana	Nevada
Utah	Arizona
New Mexico	Colorado
Texas	Wyoming
Kansas	Nebraska
South Dakota	North Dakota

The company is working to officially launch the solution in the Northeast, Southeast, Midwest, and Hawaii in the coming months.

The Eagle Solar Roof powered by SolarSave Integrated Solutions is offered through a strategic relationship between Eagle

Roofing Products and Open Energy Corp., a company focused on the development and commercialization of renewable energy products. Offering its customers a powerful combination of solar roofing solution and successful marketing strategy, Eagle and Open Energy have developed a comprehensive training program for interested contractors such as roofers, electricians, and solar integrators. The program covers proper installation, solar sales, and customer support. To date, more than 300 contractors in the Western states have completed the program authorizing them to sell the products, and 2,000 more contractors are expected to participate in the training course in the coming year. In addition, comprehensive training for builder sales staff is available.

The solar panels used in the Eagle Solar Roof are extremely low maintenance, requiring minimal care by homeowners. The resulting installation provides quiet and reliable power generation, reducing pollution and green house gas emissions while delivering safe and secure sustainable energy. The panels used in the Eagle Solar Roof come with a 25-year limited power output warranty and protection against water intrusion. It also comes with 10 years of free Internet-based solar-system monitoring for homeowners.

For additional information on Eagle Roofing Products, contact Melissa Pellerito, Eagle's marketing communications manager, at 909 355 7000 or visit www.eagleroofing.com.

GREENGUARD Expands To Certify Computers And Electronics

GREENGUARD Environmental Institute (GEI), the nation's largest certifier of chemical emissions from building products and furnishings, has announced the expansion of its certification efforts to include computers and other electronic devices. "Electronics, including monitors, computers, and printers, can emit chemicals and particles into the air, particularly when in use," says Carl E. Smith, CEO of GEI. "These chemicals may trigger a range of health issues, including asthma, allergies, and other irritating reactions."

With this new certification, consumers now have a way to identify computers and other electronic products that have been subjected to rigorous testing, and found to be free of toxic emissions. GEI runs the only program in the U.S. that certifies computers, printers, and other electronic devices for chemical emissions. The GREENGUARD program measures chemical "outgassing" of the product during normal use and operation. Measured emissions are then compared to an extensive list of publicly available short-term and long-term health risk exposure levels available from the U.S. Environmental Protection Agency, Occupational Safety Health Administration, the State of California, and Centers for Disease Control and Prevention's Registry of Toxic Substances. For almost twenty years, researchers have reported on emissions of potentially harmful chemicals from electronic devices. In Europe, the chemical content of computing and electronic devices are controlled through recently enacted European Union regulation, known as the RoHS Directive, and through certification of chemical emissions, under programs like Germany's Blue Angel. The U.S. has yet to adopt similar requirements, although some jurisdictions and other organizations are exploring the issue.

Lenovo's M57/M57P Eco is the first GREENGUARD Certified computer. It also is the First ThinkCentre product with recycled, post-consumer plastics, EPEAT Gold rated, and ENERGY STAR® 4.0 rated. "The M57/M57P raised the bar by developing a small, compact offering that provides the highest levels of manageability and security while operating with less power consumption and noise," said Fran O'Sullivan, Senior Vice President of Products, Lenovo. "With GREENGUARD Certification, this is Lenovo's most environmentally sensitive ThinkCentre ever!"

GEI, founded in 2001, currently certifies over 150,000 products and materials for emissions of volatile organic compounds (VOCs) and other chemicals. GREENGUARD Certification is broadly recognized and accepted by a number of "green" building programs, including the United States Green Building Council's (USGBC) LEED® program. An online guide of GREENGUARD Certified products is available at www.greenguard.org at no cost to the user.

FHA Loan Size Increase

The maximum FHA (Federal Housing Administration) loan size has been substantially increased by recently passed economic stimulus legislation. FHA loan limits have nearly doubled. The program is designed to provide FHA-insured mortgages to home buyers with little down payment or homeowners wanting to refinance a fixed-rate or adjustable loan but having little equity. The maximum FHA loan amount is $729,750 in high-cost housing market areas and less in lower-cost areas. Applicants are required to verify income and assets, as well as to provide a full home appraisal.

Celebrating The Synthesis Of Architecture And Landscape

Renowned architect and landscape architect Peter Gisolfi follows a principle often lacking in the dozens of television shows, which highlight building, renovation, and design techniques. Put simply, he believes architecture should always be connected to and designed in harmony with natural and man-made landscapes. Gisolfi's new book, *Finding The Place Of Architecture In The Landscape* (Images Publishing, Spring 2008) showcases this distinctive point of view.

His book, part of the Master Architect Series, is a 292-page large format book containing over 400 full-color photographs, renderings, site diagrams, and concept drawings that provide clear insights into his design philosophy. The handsome volume focuses on buildings and settings of many kinds, each reflecting the Peter Gisolfi Associates approach to design. Many of the projects detailed in the book have won major design awards and have been featured in many books, national magazines, and newspapers.

"To me, landscape encompasses what currently exists, whether it's the landscape of a city or undisturbed land," says Gisolfi. "As a society, we tend to locate buildings haphazardly, but, when landscapes and buildings are considered together, the built environment that results functions better and is more harmonious."

Sustainability is incorporated into every Gisolfi design; he believes living in harmony with nature starts with truly understanding and appreciating multiple environments.

Yale University Professor Emeritus Vincent J. Scully comments on the Gisolfi style, "It tends to create intrinsically organized new communities that get along with the old ones and can themselves endure, where trees are as important as buildings and everything can age together, growing old and better suited to each other with the passage of years."

Relationship Guide For Couples To Manage Home Building Process

Building A House Together: A Couple's Guide To Managing Their Relationship During The Construction Process is a relationship guide to help couples manage the often stressful process of building a home together.

Designed for the couple and the professional builder who is working with them, this book addresses the importance of communication, teamwork, and mutual appreciation of differences as the foundation to a great relationship and a great home building experience.

"This book is an invaluable tool for assisting our client couples to move smoothly through the decision-making process, keeping construction on schedule while maintaining their relationship. I recommend this book for all custom home builders and their clients," says Tim Alexander, President, Home Source R.E. and Construction, Inc.

Part Home Building 101, part couple's coaching, *Building A House Together* includes worksheets that clarify roles and responsibilities between the couple and with the builder during the building process. The book also helps couples understand their individual decision-making styles and how to make the most of those differences while working together.

"This is one of those rare and inspired books that make the daunting undertaking of a couple building a home together without demolishing their relationship seem really do-able," says Cheri Brackett, licensed therapist.

Written by Alice and Jared Massanari, licensed therapists who have been married 42 years and have shared the experience of building their home together, the book draws on personal experience and professional training in equal measure.

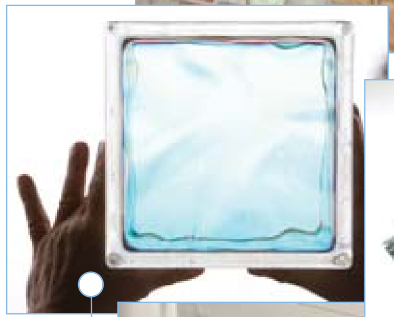
"When we started building our house together, we knew there would be certain stressors: budget issues, deadlines, hurried decisions, and the discovery of 'problems' at the job site itself. What we didn't expect was how much work we would have to do to 'manage' our relationship during the construction process. We decided to share with other couples the best of what we learned about how to make efficient use of our 'relationship energy' to complete a project that truly reflects both of us," says Alice.

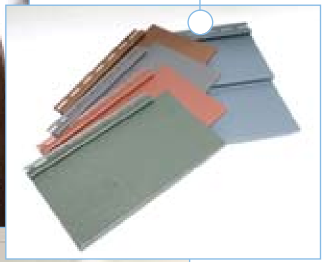
New to the neighborhood

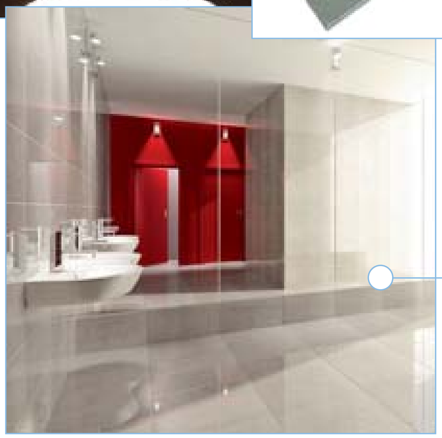
David DelGrosso & Tricia Spears

Hakatai has improved and expanded its popular Ashland series, and is now comprised of between 30 and 70 percent recycled glass from bottles and/or other waste glass that would otherwise enter the solid waste stream. In addition to the new content, Hakatai has added new colors, sizes, and finishes. This new series offers architects, designers, and homeowners an environmentally friendly glass mosaic tile option for commercial or residential projects.

Beauty and elegance combine with recycled content to give this tile a unique appeal. With a large selection of transparent and opaque colors, iridescent hues, and new matte finishes, the Ashland-e series is suitable for many applications, including interior and exterior walls, countertops, and backsplashes. Most colors are available in more than one finish. Opaque colors are mesh-backed; translucent colors are paper-faced. For more information: visit www.hakatai.com.







The new Color Mirage glass blocks from the **Applied Coatings Group** (ACG), represent a never-before-seen line of decorative glass blocks that manage the reflection, transmission, and absorption of light using dichroic thin film technology. The result: each glass block has its own brilliant color characteristics based on the glass pattern selected, the design of the color, and the intensity and direction of the light source.

The new glass blocks from Color Mirage actually change in perceived color, based on the specific light source, the angle of the light, the angle of the viewer, and the texture of the surface. Depending on the pattern, each glass block will transmit or reflect different subtle characteristics, thus the name…Color Mirage.

Available in a multitude of glass patterns, sizes, and colors, these products are ideal for interior use such as kitchen counters and backsplashes, interior shower walls, partition walls, and accessory pieces. For more information: visit www.appliedcoatingsgroup.com.

Lubrizol has introduced a patented new formulation that provides builders, remodelers, and homeowners with performance benefits never before possible with any other exterior cladding material. TempRite HDX220 Technology is made from engineered thermoplastic technology, which has been successfully used in other building products, such as dark-colored window applications, for nearly 50 years.

Lubrizol has tested dark-colored cladding made from TempRite HDX200 Technology for nearly 10 years on homes throughout the U.S. No warping, popping, or color fade has occurred, even in the most extreme environmental conditions. This technology also provides superior impact resistance and can be manufactured into a variety of popular profiles, including wide, foam-backed designs. TempRite HDX220 Technology also helps solve reflective light issues from low-energy glass in windows, which is an ongoing problem for builders and homeowners across the country due to excessive heat buildup on the cladding, which can cause distortion. For more information: visit www.tempritehdx220.com.

Ilva has launched ECO Land, a new porcelain tile series composed of natural compounds, such as clay, sand, and water, for exterior walls, interior walls, and floors of both residential and commercial installations. To help protect our environment, 15 percent of materials used during Ilva's technologically superior manufacturing process are recycled.

ECO Land consists of seven colors to meet a wide range of commercial and residential applications: Deserts (white), Canyons (beige), Beaches (sand), Mountains (brown), Caves (gray), Vulcans (red), and Jungles (green). All colors are available in three textures: polished, unpolished, and textured, and every tile is coated with a subtle sheen that is sprayed on the tile before firing, known as the Ilva-Clean feature. Ilva-Clean closes surface pores to produce a permanent finish that enhances color and maintains the surface's appearance, even between routine maintenance sessions. For more information: visit www.ilva.com.ar.

PRODUCT showcase

UFLOOR is introducing a combination of Pallmann brand, water-based bonding, sealing, and finishing products to fill joints and seal and finish floors all in one day. By combining the bonding elements of Pall-X Kitt, the Pall-X 325 spotless optical sealing effect, and the Pall-X 96 rapid-drying finish, installers now have a time-and-labor saving solution for the surface treatment of wood flooring.

Pall-X Kitt provides a user-friendly, easy application due to its fast joint-filling capabilities. The sealer, Pall-X 325, is ready to use with good filling capacity and a one hour dry time, preparing the floors for the high-abrasion resistance of the Pall-X 96 finish. This water-based one-component wood floor finish can then be applied for a clear, natural, colorless finish for heavy-wear wood flooring. Each product is composed of a maximum VOC level of 250, allowing for a more neutral odor than solvent-based products. For more information: visit www.ufloorsystems.com.

Rubio Monocoat is a European wood-finishing product that is free of any VOC and water. Rather than simply coating the wood to be finished, Rubio Monocoat bonds itself chemically with the wood creating, a greater level of protection than traditional oils or hard wax oil finishes. It is available in over 30 colors that can be mixed to create an endless color pallet, and is easy to apply and repair. Product cost is very similar to other wood-finishing products, but due to its ability to finish and protect wood in one coat, labor savings are substantial. For more information, visit www.rubiomonocoat.com.

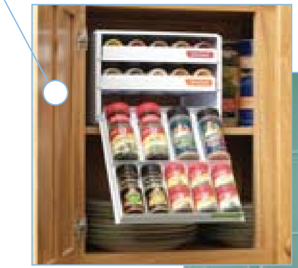
EcoSmart Fire, designers and producers of the award-winning and environmentally friendly Fireplace Collection, have introduced a fun and funky new addition to their beautiful open fireplace collection. Called Retro, this free-standing fireplace is reminiscent of the '60s with its rounded corners and tube design. Available in several colors, the Retro fits nicely in many decors.

Made from weather-resistant fiberglass, stainless steel, and toughened glass, the Retro is ideal for both indoor and sheltered outdoor locations in either commercial or residential applications. And the Retro burns environmentally friendly denatured alcohol, can heat a small room, and is virtually maintenance free. For more information: visit www.ecosmartfire.com.

In the home, equipment cables and wires are not only unsightly, they can be a menace. Poised and ready to trip all who pass, cables and wires are far more than an ugly nuisance.

Small children and common household animals like cats, dogs, rabbits, and ferrets often see equipment wires as play things—all too often as chew toys. Clearly, such a circumstance puts the child or pet at great bodily risk, with electric shock and strangulation at the top of the list. Even if the loved one evades harm, significant damage could be caused to the associated electronic equipment.

To avoid a litany of homestead hazards, the experts at **CableOrganizer.com** offer a wide range of quick, simple, and inexpensive safety solutions. For more information: visit www.CableOrganizer.com.



Are you tired of digging through your cabinets looking for your spices? **SpiceStack™** is the perfect solution for those who don't have built-in spice racks or drawers. The 11-inch wide, 10-3/4-inch deep, and 8-inch tall SpiceStack offers three pull-out, drop-down drawers that slide out easily, offering the user the ability to identify and choose his or her spices quickly and easily. Able to hold up to 27 full-size or 54 half-size spice bottles, or any combination of the two sizes, the cabinet features four non-skid pads on the bottom of the unit to hold it securely in place. Requiring no assembly, the SpiceStack is made of white, durable plastic and fits inside virtually any kitchen cabinet. Manufactured in the United States, the SpiceStack is available for $29.95. To learn more, visit them at www.spicestack.com or phone 866 247 9459.

Satinjet's Awatea showers let you enjoy your shower and save water at the same time. The Awatea water-saving showerhead creates a gushing waterfall that maintains temperature. The twin jet technology offers a soft distribution of spray pressure and temperature that provides a silky, luxurious shower suitable for all water pressures. The strictest water conservation requirements dictate that low-flow showerheads be restricted to 2.5 gallons per minute, and with Satinjet, 2.5 gallons per minute feels every bit as luxurious as a high-flow shower. A simple, five-minute installation transforms an ordinary shower into a virtual waterfall of luxury. Available from $150 for the handshower to $370 for the Wall Bar Set, you can learn more about Satinjet by visiting them at www.satinjet.com or phoning 800 975 5409.

Eliminating the need to store heavy tableware in hard-to-reach places, **Studio Becker®** utilizes convenient pull-outs for safe and accessible storage, optimizing your kitchen's base cabinets, with the Accessory Collection®. The China Storage features exclusive custom-fit wooden inserts that are designed to nestle perfectly together, and the Stemware Storage is specially designed with open bottoms for an unobstructed view of items below. The felt-lined scoops individually protect and separate delicate glasses. Just two of the many unique features in the company's accessory program, Studio Becker's accessories ensure a convenient, perfectly designed place for everything in your kitchen. For more information, phone them at 510 865 1616 or visit www.studiobecker.com.

Pet doors have come a long way, and with the **Classy Custom Pet Portal™**, your pooch's entry into or exit from your home no longer has to be an eyesore. The patent-pending, engineered design is easily customizable for any door and is available in either the Stainless Steel Magnum with a handsome dead bolt lock for increased safety and protection, or the Sherbet Alley Deluxe, which combines the durable design of the original Pet Portal in strong plastic with a painted steel security door available in a wide variety of mix n' match colors. Classy Custom's weather-tight silicone flap, with continuous magnetic edges, is extremely durable and seals out the weather. Also available are the Pet Portal Frames and Frame Sets, which come in a variety of styles and colors to match the interior of your home. All frames are interchangeable and easily applied to the Classy Custom Pet Portal. Visit them at www.classycustom.com or phone 866 615 6228.

The First Optimum Performance Home®

site and foundation preparation part XV

Architectural Illustration By Ronald Devesa

Gary Reber

synopsis

- **The project's concrete mixes use Portland Cement, Kryton's KIM admixture, Euclid Eucon A+ admixture, and 40 percent fly ash.**
- **Waterproofing was one of the most important factors when dealing with the super saturated clay soils, which are prevalent at the building site.**
- **A significant element in the proper functioning of the dedicated Optimum Performance Home Theatre is the insulated Spunstrand underground air-conditioning duct system that will deliver low-velocity ultra-quiet airflow circulation in the acoustically treated theatre.**
- **The radiant floor portions of the five-inch thick suspended concrete slab and under-slab insulation will be encased at the perimeters with the EnergyEdge® eight-inch Frame Building Rail.**
- **Under the slab, covering a granular mixture compacted over the soil, will be a Cosella-Dörken® DELTA®-MS UNDERSLAB waterproofing and vapor-retarder membrane designed for slabs on or below grade and a rigid Type II R-4 (per inch) 2-3/4-inch R-Control® Perform Guard EPS (expanded polystyrene) insulation from AFM Corporation.**

Introduction

After five years of design and plan development work, the first Optimum Performance Home® is now under construction.

This is the fifteenth article in the series documenting the design and construction of the first Optimum Performance Home. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, their new green build certification initiative, and the goal is Platinum certification.

The home is being built at The Sea Ranch, located in Sonoma County, along the Northern California coastline of the Pacific Ocean, approximately 110 miles north of San Francisco.

To document the day-to-day construction of the home, an iBeam Systems time-lapse construction camera is up and running. Visit http://www.ultimatehomedesign.com then click on the "Optimum Performance Home Build Cam" button.

Using iBeam's technology, our team is able to view a high-resolution photo archive of the entire project on a daily basis, including stunning 1920 x 1080p (progressive) high-definition time-lapse movies each month (see a standard-resolution version at www.ultimatehomedesign.com).

Photos are captured and automatically uploaded to iBeam's secure server every 15 minutes from 6:00 a.m. to 6:00 p.m. each day. They can be viewed through the directed link on the *Ultimate Home Design* Web site. Furthermore, the images can easily be e-mailed or printed to document job site conditions.

YOUR NEIGHBORS WILL BE
GREEN WITH ENVY.

YOU'LL JUST BE GREEN.

Whether you're building a dream garage or a custom outdoor living space, for a beautiful high-gloss concrete finish that's truly safer for the environment demand earth-friendly GREEN UMBRELLA™ polished concrete treatments. Combining industry-leading performance with environmentally sensitive chemistry, GREEN UMBRELLA products are easy to apply, simple to maintain, and highly resistant to automotive oils and corrosive household chemicals.

Sure, your car is probably happy.
But the earth REALLY appreciates it.

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Call us today at **816.448.2036** or visit us at **www.greenpolishing.com** for more details.
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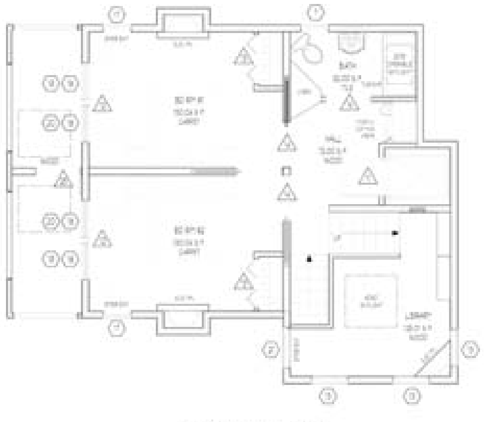
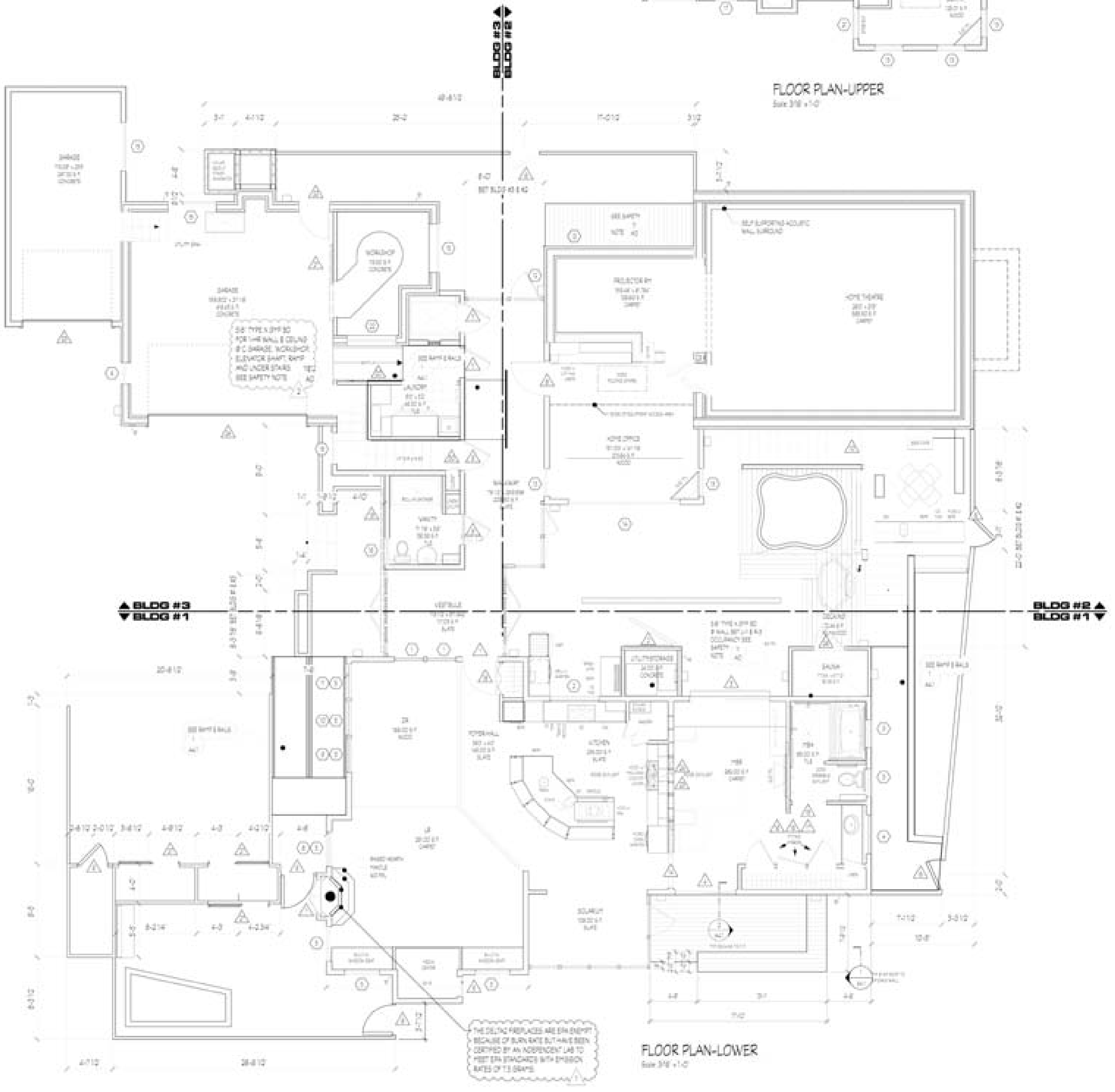
The First Optimum Performance Home® At The Sea Ranch



FLOOR PLAN-UPPER



FLOOR PLAN-LOWER

DESIGN
optimum performance home

The Sea Ranch, Sonoma County, California
Aerial Photo Courtesy Scott Simpson

At the conclusion, the entire construction photo archive will be featured as a 1080p high-definition time-lapse movie and will become part of a high-definition television program and educational documentary that Steve Michelson Productions and I are producing.

Ultimate Home Design® Concept

The showcase project is exemplary of the "Ultimate Home Design®" concept, which integrates age-friendly universal design with the best sustainable building practices, while exerting minimal impact on the natural environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure; as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

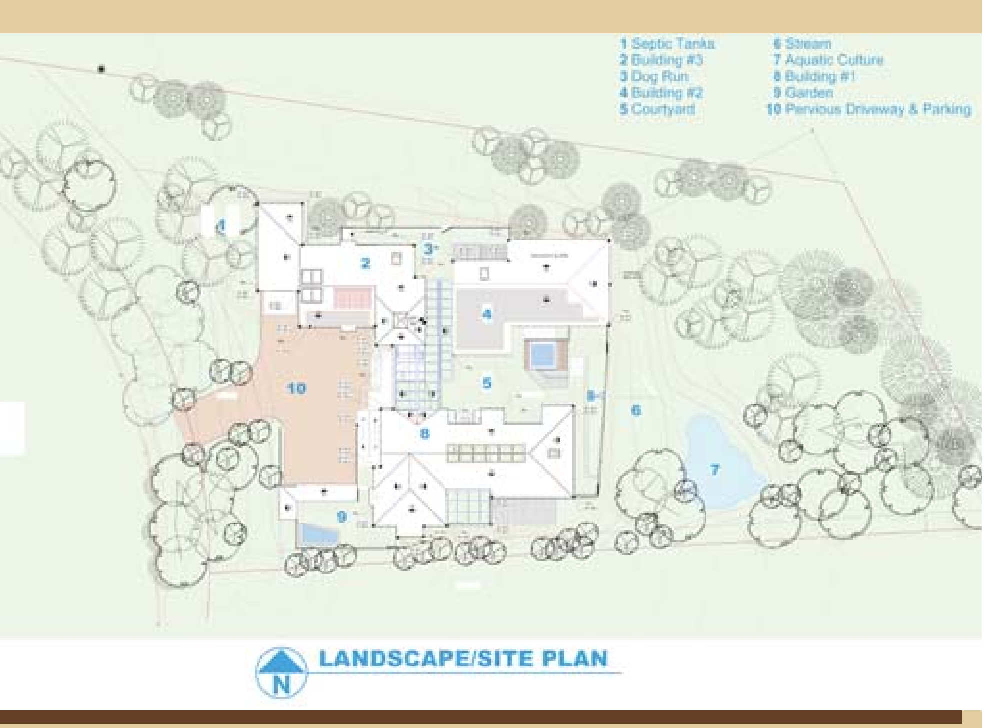
A building-science systems approach to home building is the cornerstone of the project, with emphasis on the relationship between the home's components and the envelope they create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners and the surrounding natural setting, and resource efficiency. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

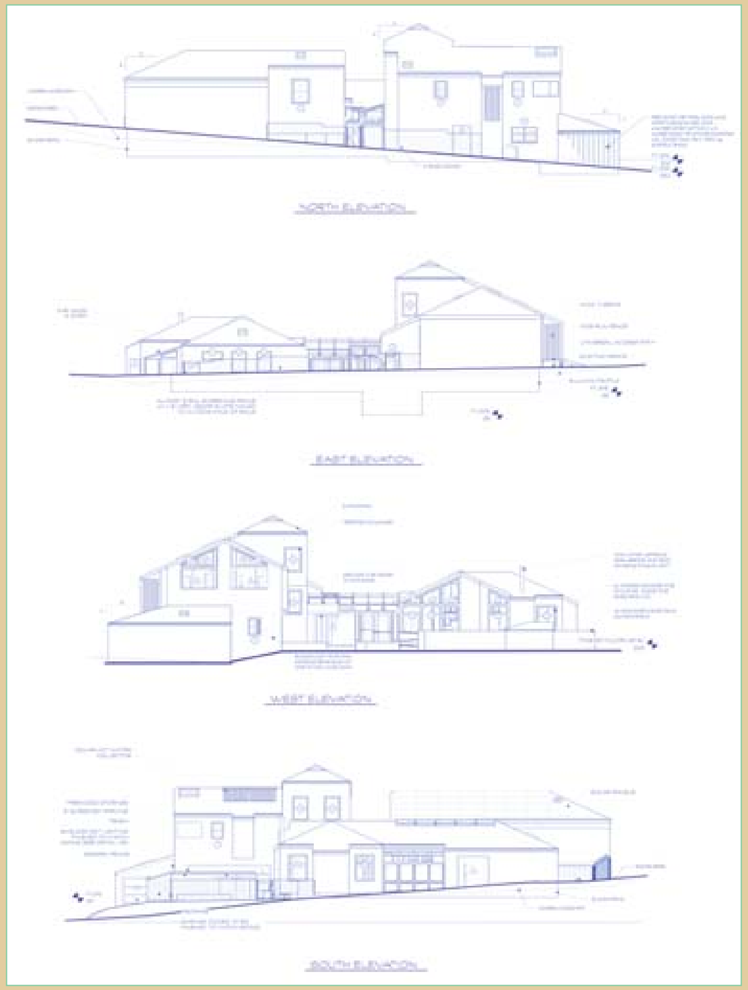
Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article covered the project scope. Thereafter, each issue has contained a part of the continuing series by working through site planning and preparation; Low-Impact Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee-approved architectural/structural and grading/ drainage submittals with conditions that translated to clarifications on certain building components and material finishes; particular aspects of the home's mechanical plan; structural aspects of foundations, structural walls incorporating Insulating Concrete Forms (ICFs), and Structural Insulated Panels (SIPs), as well as roofing; the acoustical design of the dedicated Optimum Performance Home Theatre™ and rear-projection room; interior design approaches and materials; kitchen, bath, and home fixtures; universal design architecture; fire-risk mitigation; energy generation; and courtyard experience. "Breaking Ground" was the title of Part XIII, along with "Courtyard Experience." Part XIV covered the initial phases of "Site And Foundation Preparation."

Construction remains at the initial site grading, foundation, and mechanical, plumbing, electrical, and low-voltage infrastructure stages. This work is documented in the day-to-day time-lapse photography and archived photos on the Ultimate Home Design Web site.

Completion of the home is anticipated for December 2008. It is our intent to produce a high-definition documentary for educational use by the U.S. Green Building Council, the organization who created the LEED for Homes rating and certification program. Our presentation will reveal the step-by-step process for creating the first Optimum Performance Home—expected to be one of the highest rated, if not the highest, LEED for Homes Platinum residential home in the world!

> "The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental impact, as well as provide a nurturing home environment to support independent living and sustainable lifestyles."





The elevations of the Optimum Performance Home at The Sea Ranch

Construction Scheduling

Below is the breakdown of the initial site preparation and grading process and foundation work completed or under way. An outline will be provided in Part XVI for the next stage of construction relating to the completed below slab infrastructure and above the slab Amvic ICF and ThermaSAVE SIP walls and roofing.

Pre-Construction Start Meetings

Site Work

- Clear Lot Vegetation
- Lay Out House Pad
- Install Curtain Drain Around Pad
- Excavate Optimum Performance Home Theatre, Alcove, Wine Cellar Lay Out Footings
- Temporary Electrical Power
- Install iBeam Systems Time-Lapse Pro Construction Camera (See Part XIII)
- Install GetWireless and WildBlue Internet Transmission
- Activate Water Service
- Form Underground ICF Home Theatre, Alcove, and Wine Cellar Walls
- Verify Foundations' Site Placement/Inspection
- Rough Excavation Large Pond and Septic Trench to Designated Leech Field
- Install StormTech Infiltration Chambers (See Parts II, III, and IV)

Foundations

- Dig Initial Stage Foundation Footings and Install French Drain
- Pour First Stage Engineered Controlled Density Fill (CDF) Concrete with Portland Cement and Headwaters Resources Fly Ash (See Part VI)
- Set Forms, Tie Rebar Steel, Hold Downs and Anchor Bolts
- Pour Final Stage Foundation Footing Concrete with Portland Cement, Headwaters Resources Fly Ash, Kryton's KIM Admixture, and Euclid Eucon Admixture (See Part VI)
- Run Spunstrand Air-Conditioning Duct for Home Theatre (See Part V)
- Conduit Trenching for Uponor AQUAPEX Plumbing (See Part V and X)
- Run Armacell Insulated Uponor AQUAPEX Tubing
- Run Plumbing Waste
- Run Wardflex Flexible Corrugated Stainless Steel Fuel Gas Tubing
- Run Underground Water Line from Pond to the Boat Garage for Fire Hose Connection (See Part XI)
- Install Gravel Around Plumbing
- Run Plumbing Conduit and Supply
- Run Electrical and Low-Voltage Conduit
- Lay Out NuTone Central Vacuum System (See Parts IX and X)
- Finalize Underslab Infrastructure and Zurn Flo-Thru Trench Drain
- Underslab Inspection
- Place Gravel and Sand Underslab
- Install Cosella-Dörken DELTA-MS UNDER-SLAB
- Install AMF Corporation R-Control Perform Guard EPS Underslab Insulation
- Install EnergyEdge Insulated Form Around Perimeter of Slab
- Install AMF Corporation R-Control Perform Guard EPS Around Perimeter of Slab
- Prepare for In-Floor D-Box™ Technologies Custom Motion Platform In Home Theatre (See Part VII)
- Install Slab Rebar
- Install Uponor AQUAPEX Radiant Floor Tubing
- Pour Concrete Slab
- Treat Concrete Slab with Nisus Corporation Bora-Care Termite Barrier Pretreatment
- Waterproof Home Theatre, Alcove, and Wine Cellar Walls with Carlisle Coatings
- Backfill Foundation

Septic System

- Dig Septic Trench, Cut Road, Install Pipes, Backfill Trench, and Repair Road

The site preparation work is being done by Sonoma County Builders, Inc. under the direction of Noble and Loyal Davis. This company, based both in Santa Rosa and Point Arena, California, has had extensive experience in excavation for both residential and commercial/civic projects for over 35 years. They are very supportive of the project and sensitive to the environmental concerns and protections that are in place for the project. Prior to the start of their excavation work, the tall grasses were cut down by Steve Glaze (Steve Glaze Backhoe). This top layer of roots is being stockpiled along with the extensive mud excavated and allowed to form a "top soil" compost for later spreading back over the site, just prior to landscaping with indigenous vegetation and trees. John Feeney, our on-site supervising contractor and lead carpenter, and his carpenter team consisting of Ian Currie, Jerry Feeney, and Aaron Phillips are performing the foundation work. Sebastopol, California-based Weeks Drilling & Pump Company, under the direction of Chris Thompson, CEO, will drill the five 310-feet-deep geothermal bore holes after the foundation work is completed. Don Bartlett of Bartlett Mechanical Services will install the WaterFurnace® geothermal and complete the interface with the

Excavation of septic tank affluent transfer pipeline route

Affluent transfer pipeline crossing road; initial stage of pond excavation

Stormwater Solutions EcoRain™ Tank Modules

• Underground modular water cistern tanks manufactured with 100 percent recycled plastic. The modular tanks can be used to create any size void space underground by just butting them to one another. A 40-millimeter thick membrane encases the tanks to hold the recycled water harvested from the roofs.

WaterFurnace system with the Spunstrand underground acoustically damped air-conditioning duct system. The Spunstrand system was constructed and installed by Jerry Feeney and John Feeney. Bill Wilson Environmental Planning and Design, LLC with Dylan Coleman, principal in Mt. Shasta, California-based Wonderwater, are responsible for the on-site water-management systems, including the pond and drains. Aqua Harvest International's Terry McMains, based in Rio Rancho, New Mexico, designed the site application of the EcoRain™ Stormwater Tank Modules underground water cistern manufactured by Stormwater Solutions, LLC.

Sonoma County Builders have completed the initial off-site septic system work, including digging the septic tank affluent transfer pipe line from the home site to The Sea Ranch-designated leech field, approximately 1,200 feet away; cutting the pavement across Timber Ridge Road east of the site, under which the septic pipe will transverse; installing the septic pipe in the trench; backfilling the trench; and repairing the surface of the road. During this procedure the excavator was careful to protect tree root systems, digging those areas of the trench by hand. Thus, all of the tree roots were preserved during the work, and the ground was restored.

GetWireless And WildBlue™ Satellite Speed Internet®

In order to facilitate capturing the high-resolution images taken on-site by the iBeam Time-Lapse Pro Construction camera, an "always on" GetWireless AirLink Raven X EVDO V4221-VA and AirLink Dual-Band EVDO Antenna is being employed. This system provides the Ethernet Internet interface for the Verizon Wireless Broadband uplink service for the iBeam Systems time-lapse camera on the construction site.

iBeam Time-Lapse Pro Construction Camera Perspective

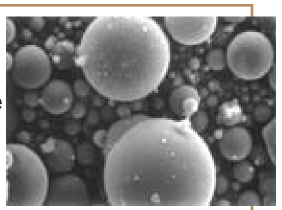
A WildBlue™ Satellite Speed Internet® system developed by WildBlue Communications, Inc. and offered as part of EcoStar's DISH Network satellite services is being used on the site for Internet connectivity. The offer is provided separately under the EchoStar brand name, and sub-branded as "powered by WildBlue." The new WildBlue Enterprise Solutions™ satellite services system offers business-class broadband connectivity via state-of-the-art satellite technology, using a 26-inch satellite mini-dish equipped with both a transmitter and receiver for two-way satellite connectivity to the Internet. See Part XIII for a full description of the service.

This Issue

In this issue, the focus will be on the various construction elements related to site and foundation preparation.

The site's soil conditions (see Part XIV) resulted in extensive additional excavation work, including digging trenches around and within the perimeter of each building in the three-building compound. Deep trenches were necessary to reach the deeper laying bedrock. A specially engineered Controlled Density Fill (CDF) concrete mix was designed to fill the voids and provide a strong, stabilized surface upon which to support the foundation footings. CDF, also known as "flowable flow," is an engineered, controlled, concrete-fill material, which is self-placing, self-leveling, self-compacting, and non-settling. Our particular formula required a concrete mix consisting of equal amounts of Portland Cement and fly ash, water, and 3/8-inch aggregate and concrete sand. The so-called "two-sack mix" consisted of 188 pounds of Portland Cement per cubic yard in the

Headwaters Resources

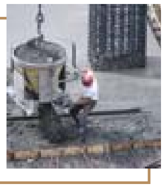


- Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental benefits through stewardship of an abundant industrial resource. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And concrete containing fly ash becomes even stronger over time compared to concrete made only with cement.

Kryton's KIM® Admixture System

- KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability. The advanced integral crystalline chemicals react with water and unhydrated cement particles to form millions of needle-like crystals to permanently block the pathways for water and waterborne contaminants.

Euclid Eucon A+



- Euclid Chemical Company's Eucon A+ Type A admixture serves as a fast-setting, water-reducing, and plasticizing admixture for concrete that does not adversely affect concrete set times.

Suspended Slab-On-Grade Compactive Strength 3,000 Pounds Per Square Inch (PSI) 56 Days (See Note 2)		
Materials	**Slab-On-Grade**	**Moisture Adjusted**
Cement (Pounds)	360	360
Fly Ash (Pounds)	240	240
Water (Pounds)	270	196 Pounds (23.5 Gallons)
1 Inch x #4 CA (Pounds)	1,276	1,286 (6 Pounds)
3/8 Inch x #8 CA (Pounds)	400	402 (2 Pounds)
Concrete Sand (Pounds)	1,322	1,388 (66 Pounds)
Eucon A+ (Ounces Per Yard)	18	18
Target W/C Ratio	0.45	0.45
Kryton KIM	11 Pounds Per Yard	11 Pounds Per Yard
Slump + 1 Inch / - 2 Inch	4.0 Inch	See Note 1

Note 1—PLEASE NOTE! With higher volumes of fly ash in concrete mixes the slump will read differently than when conventional concrete is being delivered. The rule of thumb is to arrive on the project with meters reading a 2.5-inch slump if the concrete is ordered at a 4.0-inch slump. After first round, adjust accordingly.
Note 2—Mixes are designed to achieve 3,000 psi in 56 days when cylinders are cured in accordance with ASTM C31/C31M-08 Standard Practice for Making and Curing Concrete Test Specimens in the Field and tested in accordance to ASTM C39/C39M-05e1 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

final concrete mix and an equal fly ash pound-weight. One sack of Portland Cement weighs 94 pounds. The mix design was formulated by Doug Yeggy at Headwaters Resources. Headwaters Resources is the source of the fly ash that will be used in the concrete mixes designed for the project. The Portland Cement Association and the California Portland Cement Company are the sources of the cement used in the project. Delivery of the Portland Cement and fly ash to the concrete production facility was handled by Conti Materials. The local concrete production facility is Bed Rock Products, based in Point Arena (and Gualala), California. Bed Rock Concrete Pumping is providing the concrete pumping service for the project.

Doug has designed two other concrete mixes for the project: standard foundation footing and the concrete to be poured into the Amvic ICFs, and the suspended slab-on-grade. These mixes use Portland Cement, Kryton's KIM admixture, Euclid Eucon A+ admixture, and 40 percent fly ash. The mix design for the standard foundation footings used 324 pounds of Portland Cement, 216 pounds of fly ash (40 percent), 11 pounds of KIM admixture, and 16 ounces of Eucon A+ admixture per cubic yard. The suspended slab-on-grade mix design will use, per cubic yard, 360 pounds of Portland Cement and 240 pounds of fly ash (40 percent), 11 pounds of KIM admixture, 18 ounces of Eucon A+ admixture, and FORTA® FERRO®. The Amvic ICF concrete mix design will use the mix design that was used for the standard foundation footings.

One of the unique features, which has caused quite a bit of frustration during the design phases of the Optimum Performance Home, is the naturally occurring subgrade water, which can be typical in California's coastal areas. Special design considerations were implemented to take an

DESIGN
optimum performance home

otherwise user-unfriendly building site and making it part of the Optimum Performance Home's unique character.

Waterproofing was one of the most important factors when dealing with the super saturated clay soils, which are prevalent at the building site. The over-excavated-base rock-bearing foundation and the suspended slab footings are only the first part in a very detailed waterproofing system that uses the most advanced technologies to insure that moisture will stay outside of the building envelope where it belongs. Each individual part of the waterproofing system puts its own unique fingerprint on the other parts in the system and has had our suppliers and engineers working overtime to come up with solutions at every turned page of the plans or specification detail.

The most recent change has come in the concrete mix design for the suspended slab-on-grade. Originally designed at 5.50 sack with 30 percent fly ash replacement, as well as Kryton's KIM waterproofing admixture and Euclids Eucon A+ water reducer (see Note 1), a change has been made to decrease the water-to-cement ratio down to a 0.45 water-to-cement ratio, which will help accommodate some of the design features of the DELTA MS UNDERSLAB waterproofing and vapor-retarding system—one of the more critical features of our Integrated Water Proofing System.

The reason for this change is as much due to the superior vapor-retarding capabilities of the DELTA product as it is to concrete's ability to be permeable. As discussed in an earlier article in this series, as concrete is being poured, water tends to collect on the surface as particles settle (also known as bleeding). The impermeable nature of vapor retarders in general has a couple of effects. They can decrease the amount of water that enters from beneath the slab and they hold water inside the barrier, which contributes to

FORTA® FERRO®

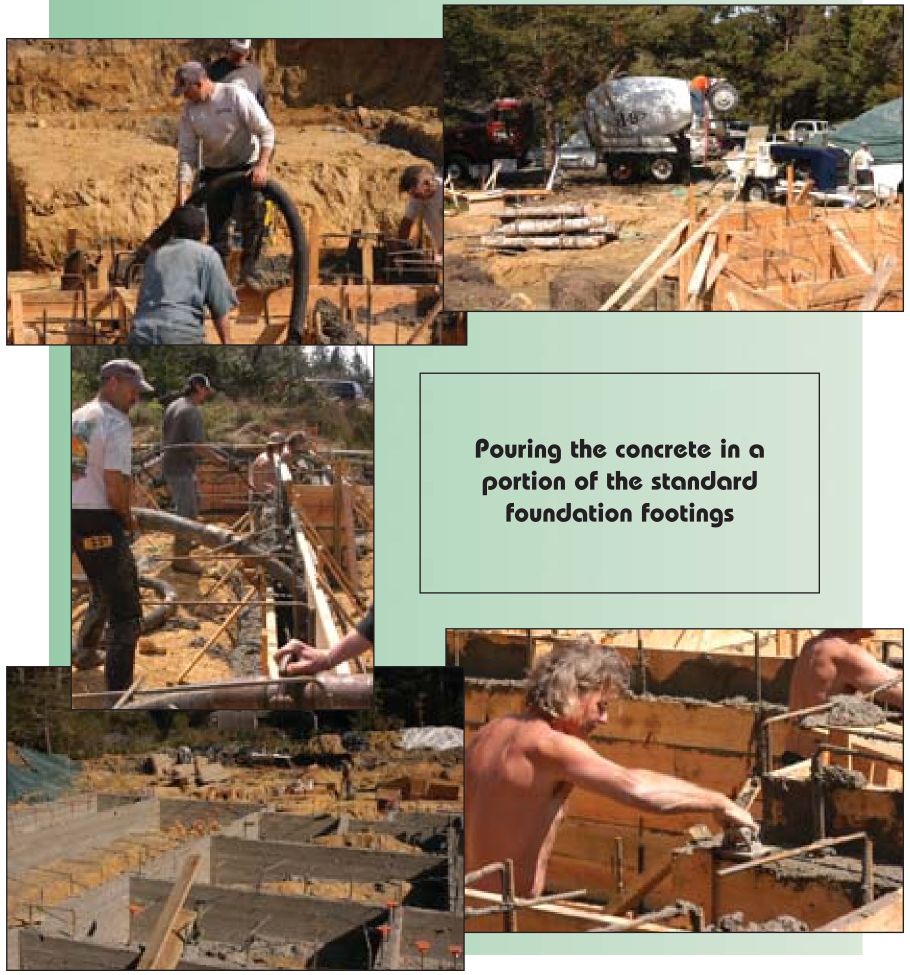
- Forta Ferro is a copolymer/propylene fiber that is used to reduce plastic and hardened concrete shrinkage prior to the initial set, reduce hardened concrete shrinkage cracking, improve impact strength, and enhance concrete toughness and durability.

Cosella-Dörken DELTA-MS UNDERSLAB

- DELTA-MS UNDERSLAB is a tough, impermeable vapor-retarding membrane that is placed on the earth or granular (adjective) prior to placing the concrete slab. The membrane provides a full capillary break and vapor retarder that prevents the upward migration of moisture through the capillaries that exist in all concrete.

R-Control® Perform Guard EPS

- Rigid Type II R-4 (per inch) 2-3/4-inch R-Control® Perform Guard EPS (expanded polystyrene) insulation from AFM Corporation provides superior thermal mass for uniform heat transfer of slab-encased radiant floor systems. Photos courtesy of AFM Corp.



Pouring the concrete in a portion of the standard foundation footings

Setting plumbing pass-through; finishing concrete pour; excavating guest parking

Forming wine cellar; concrete pour

increased curing for the concrete. The only problem that may occur, and the reason for the decrease in the water-to-cement ratio to 0.45, is the additional bleed water that may have to come out through the top of the concrete, due to the vapor retarder's ability to keep the water out as well as in.

The waffle makeup of the DELTA MS UNDERSLAB product will allow areas for the water to go during initial placement, which will decrease the bleeding concerns. To further reduce the permeability of the concrete, and to insure additional protection in the very wet environment, we increased the percentage of fly ash (see Doug Yeggy's "High Volume Fly Ash—A Tool For The Concrete Designer's Toolbelt" in Part XIV), which reduces the water of convenience (water needed to place concrete) and the percentage of permeable voids, and is reflected by a reduction in bleed water channels, which is the road that allows water to transfer through concrete.

Note 1—We were originally going to submit the 5.50 sack 30 percent fly ash mix and plead our case for the innovation point in the LEED point system. Consideration should have been made by the fact that 360 pounds of cement is the minimum amount that should be used in slab-on-grade concrete to facilitate placing and finishing in a timely manner without having to 1) increase the total cementitious content by one sack or more or 2) use chemical admixtures that would increase the cost of the concrete by as much or more than if we added the previously referred extra sack of cementitious material, and 3) incur greater costs by the contractor in man-hours needed to wait until the concrete was ready to be finish troweled. However, in looking at what was done to meet the LEED requirement for innovation, which is now met with our suspended slab-on-grade mix design, it does seem somewhat foolish that we did nothing more than increase the amount of fly ash by 10 percent over the original 5.50 sack 30 percent mix, which did not meet LEED requirements for an innovation point.

KIM admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel rebar reinforcements from corrosion, and improves concrete durability. The advanced integral crystalline chemicals in the KIM admixture react with water and unhydrated Portland Cement particles to form millions of needle-like crystals to permanently block the pathways for water and waterborne contaminants.

Euclid Chemical Company's Eucon A+ Type A admixture serves as a fast-setting, water-reducing, and plasticizing admixture for concrete that does not adversely affect concrete set times.

The suspended slab-on-grade mix design incorporates FORTA® FERRO®, an easy-to-finish, color-blended fiber, made of 100 percent virgin copolymer/propylene consisting of a twisted bundle non-fibrillating monofilament and a fibrillating network fiber, yielding a high-performance concrete reinforcement system. This fiber provides long-term concrete durability and increased impact resistance. FORTA FERRO is used to reduce plastic and hardened concrete shrinkage prior to the initial set, reduce hardened concrete shrinkage cracking, improve impact strength, and enhance concrete toughness and durability. This extra heavy-duty fiber offers maximum long-term durability, structural enhancements, and effective secondary/temperature crack control by incorporating a truly unique synergistic fiber system of long-length design. FORTA FERRO is non-corrosive, non-magnetic, and 100 percent alkali proof. The recommended dosage rate of FORTA FERRO is 3 to 30 pounds per cubic yard of concrete added directly to the concrete mixing system during, or after, the batching of the other ingredients and mixed at the time and speed recommended by the mixer manufacturer (usually four to five minutes).

The first-stage concrete pour provided the necessary compaction strength to support the final-stage concrete-footing pour, upon which will be suspended the concrete slab. The slab will be five inches thick. Under the slab, covering a granular mixture compacted over the soil, will be a Cosella-Dörken DELTA®-MS UNDERSLAB waterproofing and vapor-retarder membrane designed for slabs on or below grade and a rigid Type II R-4 (per inch) 2-3/4-inch R-Control® Perform Guard EPS (expanded polystyrene) insulation from AFM Corporation.

DELTA-MS UNDERSLAB is a tough, impermeable vapor-retarding membrane that is placed on the earth or granular surface prior to placing the concrete. DELTA-MS UNDERSLAB prevents the early loss of hydrated water, thus producing a concrete that meets design strength and provides more even curing characteristics in concrete. The membrane offers a full-capillary break and vapor retarder that prevents the upward migration of moisture through the capillaries that exist in all concrete. Additionally DELTA-MS UNDERSLAB can act as a barrier to soil gases. This will provide a healthy and dry environment.

A 2-3/4-inch thick R-Control Perform Guard EPS will be placed over the DELTA-MS UNDERSLAB to provide superior thermal mass for uniform heat transfer of the WaterFurnace geothermal/heat pump heated water through the Uponor® 1/2-inch AQUAPEX® in-floor tubing encased in the five-inch-thick suspended concrete slab.

Prior to pouring the slab concrete, suspended over the final stage concrete footings, the Zurn® Flo-Thru trench drain that runs the full length of the courtyard will be installed. The modular Zurn molded-slop drain is designed for load-bearing strength, hydraulics, chemical resistance, and structural integrity.

A significant element in the proper functioning of the dedicated Optimum Performance Home Theatre is the insulated Spunstrand underground air-conditioning duct system that will deliver low-velocity ultra-quiet air-flow circulation in the acoustically treated theatre. The system is specially fabricated with duckboard and duct liner inserted into the energy-saving R-10 insulated Spunstrand ducts to hush background noise due to ventilation hum, self-generated air noise, and on/off ventilator switching.

Spunstrand manufactures green duct in the Pacific Northwest. The duct

Laying out Uponor AQUAPEX plumbing infrastructure under slab

Spunstrand® Filament-Wound Fiberglass Underslab Duct

• Spunstrand HVAC duct is designed for direct burial applications and is manufactured using the filament-wound method to provide the greatest strength.

Laying out Spunstrand underground air-conditioning duct

maximizes clean air flow, eliminates rust and mold growth, and provides a more comfortable environment for building occupants.

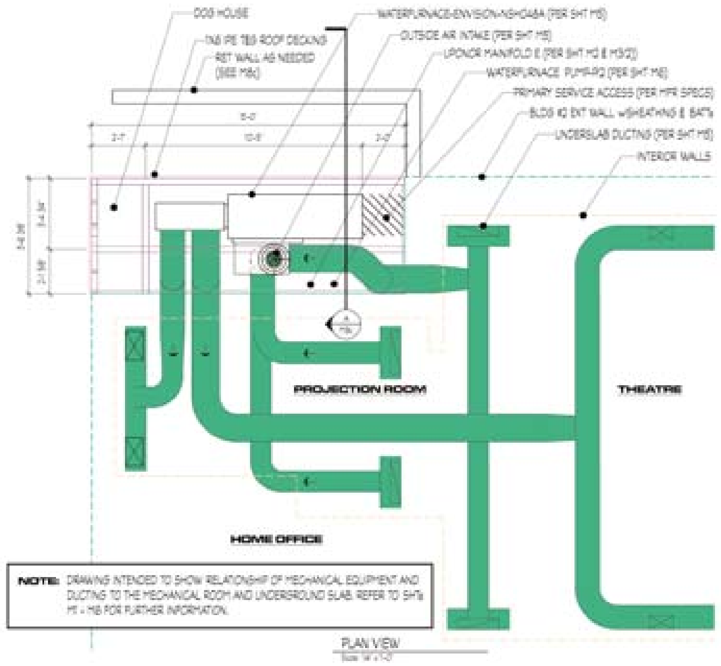
As a member of the U.S. Green Building Council, the company has demonstrated how direct-bury, underslab duct eliminates concrete encasement, as well as extra soffit framing, Sheetrock®, and insulation because of improved energy efficiency. Round 19-3/4-, 18-3/4-, and 15-3/4-inch outside diameter (16-, 14-, and 12-inch interior diameter) green Spunstrand duct was specified for the Optimum Performance Home Theatre and rear-projection room air-conditioning application.

The Spunstrand duct system meets all aspects of the Uniform and International Mechanical Codes, carrying an ICBO (International Conference of Building Officials) approval to assure top-quality manufacturing for long-lasting duct, and achieves LEED rating points. Spunstrand fiberglass reinforced plastic duct (FRP) is rated Class 1 and code approved for direct underground burial. Spunstrand duct is manufactured using the filament-wound method, where continuous fiberglass strands are impregnated with resin and machine wound on a mandrel, which has first received a foil scrim kraft surface liner. Winding continues until the desired wall thickness is reached, and then the mandrel with the duct laminate is moved to a heated curing station where it is rotated until the resin is set. The approximate glass content of the filament-wound duct is 70 percent.

The internal surface liner provides the Class 1 rating for this product, while the fiberglass fibers furnish strength, dimensional stability, and temperature resistance. The type of resin is chosen to provide chemical and electrical resistance, color, finish hardness, and thermal properties.

The radiant floor portions of the five-inch-thick suspended concrete slab and under-slab insulation will be encased at the perimeters with the EnergyEdge® eight-inch Frame Building Rail (EE8fb). The PVC channel provides full-rigid insulation coverage from the top to bottom of an eight-inch slab edge to prevent radiant floor heat loss through the edges of the concrete slab. Below the EnergyEdge will be installed eight inches of two-inch-thick R-Control Perform Guard EPS to satisfy California Title 24 insulation requirements for radiant floor slab edges.

Prior to the granular mixture fill, the placement of the DELTA-MS UNDERSLAB membrane, the R-Control Perform Guard EPS, and the Uponor AQUAPEX-encased suspended slab concrete pour, all the underground infrastructure for the home will be installed. This will include Uponor 1/2- and 3/4-inch red and blue pre-sleeved corrugated AQUAPEX tubing with outer Armacell® AP/Armaflex® pipe insulation, the NuTone® VX1000 central vacuum system, and the complex electrical and low-voltage wiring system encased in conduit. This work is underway and is expected to be completed by mid-June.



EnergyEdge® Frame Building Rail

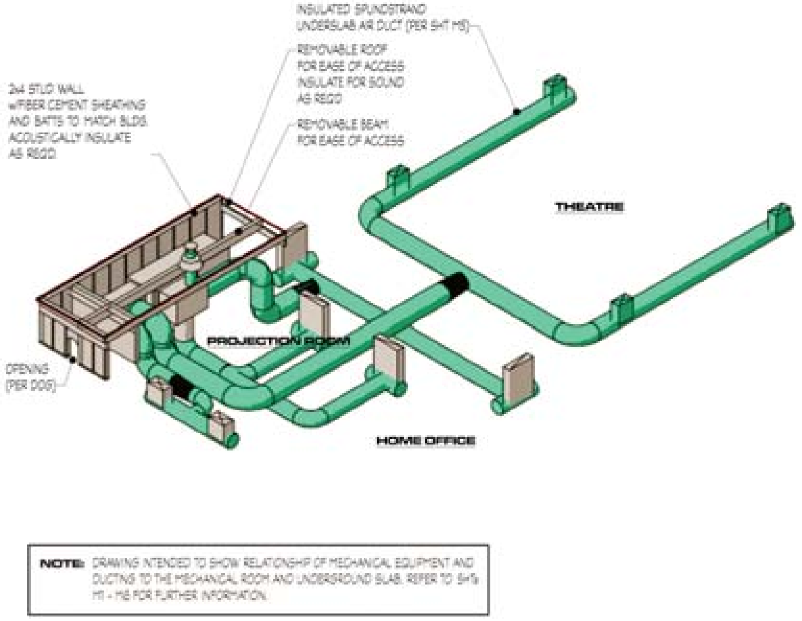
• The EnergyEdge Frame Building Rail (EE8fb) is designed to provide insulation at the radiant floor perimeters of the concrete slab. The PVC channel provides full-rigid insulation coverage from top to bottom of the slab edge to prevent radiant floor heat loss through the edges of the concrete slab.

Forming wine cellar and retaining wall/planter

Uponor's red and blue high-density polyethylene (HDPE) corrugated pre-sleeved 1/2- and 3/4-inch AQUAPEX tubing provides protection for the installation in the soil and allows for easy removal and replacement of the tubing if required over time. In addition, the red and blue color-coded sleeves easily identify hot and cold water lines. PEX is a cross-linked polyethylene. PEX flexibility and strength at temperatures ranging from below freezing up to 200-degrees Fahrenheit makes it the ideal piping material for hot and cold water plumbing systems, trouble-free fire-sprinkler systems, and hydronic radiant floor-heating systems.

Armacell AP/Armaflex® pipe (tube) insulation will be wrapped over the Uponor AQUAPEX tubing to provide additional thermal insulation. The expanded closed-cell structure of AP/Armaflex pipe insulation makes it an efficient insulation for effectively reducing heat loss on the hot-water plumbing and heat gain on the cold-water plumbing systems. It is formaldehyde free, low VOCs, fiber free, dust free, and resists mold and mildew, and is made with Microban® antimicrobial product protection for added defense against mold on the insulation. When buried under the suspended slab, the pipe tubing will be channeled through crushed rock rather than through the soil to enhance long-term durability.

Jerry Moyles and his team at Mendocino Coast Plumbing are charged with the installation of the Uponor plumbing system and the Wardflex® flexible corrugated stainless steel fuel gas tubing, which will supply propane to the KitchenAid® Architect Series® II dual-fuel 36-inch-wide range, the Wolf Range Company professional 36-inch-wide griddle, the Kohler® generator, and the Navien® tankless water heater.

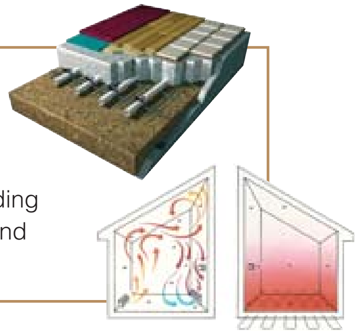


Wardflex corrugated stainless steel tubing (CSST) was selected, as it delivers more advantages over black steel pipe or ordinary CSST systems. Compared to either black steel pipe or other ordinary corrugated stainless steel tubing (CSST) systems, Wardflex delivers more performance and installation advantages. Using continuous flexible annular corrugated tubing made of 304 stainless steel, Wardflex installs without heavy carrying, threading, extensive measuring, or mess. The tubing is connected using special mechanical fittings. The continuous lengths and amazing flexibility of the fully annealed tubing greatly reduce the number of needed connections (and chances for leaks).

Roger Stevenson and his team at Stevenson Electric are charged with the complete installation of the elaborate and sophisticated electrical and low-voltage electronic systems infrastructure under the home and throughout the interior, including the extensive interfaces, fixtures, controls, and equipment and appliances powered by electricity.

Engineered Environments™ Randy Sterns, Brian Hodges, and Tim Johnson are consulting on the

Uponor® Radiant Floors



• Warm water circulates under the floors throughout the Optimum Performance Home using Uponor's durable, flexible, and resilient cross-linked polyethylene AQUAPEX tubing, providing a comfortable, even heat without stirring up dust and pollutants.

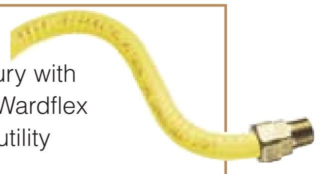
Uponor® Pre-Sleeved Corrugated AQUAPEX®

• Uponor® 1/2- and 3/4-inch red and blue high-density polyethylene (HDPE) pre-sleeved corrugated AQUAPEX® tubing is designed for durability and provides protection for installation in the soil and allows for easy removal over time.

Armacell AP/Armaflex® Pipe Insulation

• The expanded closed-cell structure of Armacell AP/Armaflex pipe insulation makes it an efficient insulation for effectively reducing heat loss on the hot-water plumbing and heat gain on the cold-water plumbing systems.

Wardflex® Flexible Fuel Gas Tubing



• Wardflex® is the gas piping system for the 21st Century with the highest overall-rated flow capacity in the industry. Wardflex is recognized as the "system of choice" by major gas utility companies.

NuTone® Central Vacuum System

• A NuTone® Central Vacuum System will be featured in the home to help maintain healthy interior air quality. NuTone's central vacuum power units feature a space-saving sleek oval-shape design, internal sound suppression system, and a status light on the hose handle and power unit, which indicates when the VX™ unit's bag or canister is full and needs emptying.

Bora-Care®

• Nisus Corporation's Bora-Care® is a primary termite barrier pre-treatment that creates a continuous barrier that termites cannot cross, eliminating their food source.

electronic systems design and installation of the home's low-voltage infrastructure and technologies.

Engineered Environments is recognized as one of the premiere residential electronic systems firms nationally, providing custom-integrated systems for discerning clientele who appreciate the benefits of properly applied new electronic technologies. Each year, the Custom Electronics Design & Installation Association (CEDIA) presents awards to winning entries submitted from its 3,000 members. The selection process is rigorous, with the judging panel made up of electronic systems contractors and American Society of Interior Designers (ASID) and American Institute of Architects (AIA) representatives. Engineered Environments' track record of winning top awards has spanned each of the past five years.

Stevenson Electric also will install the NuTone central vacuum system. The NuTone 1,040 watt cyclonic central vacuum power unit features HEPA-rated filtration, Microban protection, and Teflon antistick technology.

A three-inch filtered underground water line will be installed to serve as a surplus supply of water available from the pond. A standard 2-1/2-inch value red-painted standpipe hydrant with a male National Hose fire-thread fitting will be located at the driveway entrance at the front of the property, to which a fire hose can be connected.

Following the curing of the concrete slab, Nisus Corporation's Bora-Care® will be applied directly to the finished surface slab as a primary termite barrier pre-treatment. Bora-Care creates a continuous barrier that termites cannot cross and eliminates their food source.

The next installment in this series of case-study articles will cover the actual work being done to accomplish the tasks described, as well as the start of the above-slab Amvic ICF wall construction. In the meantime, photos will

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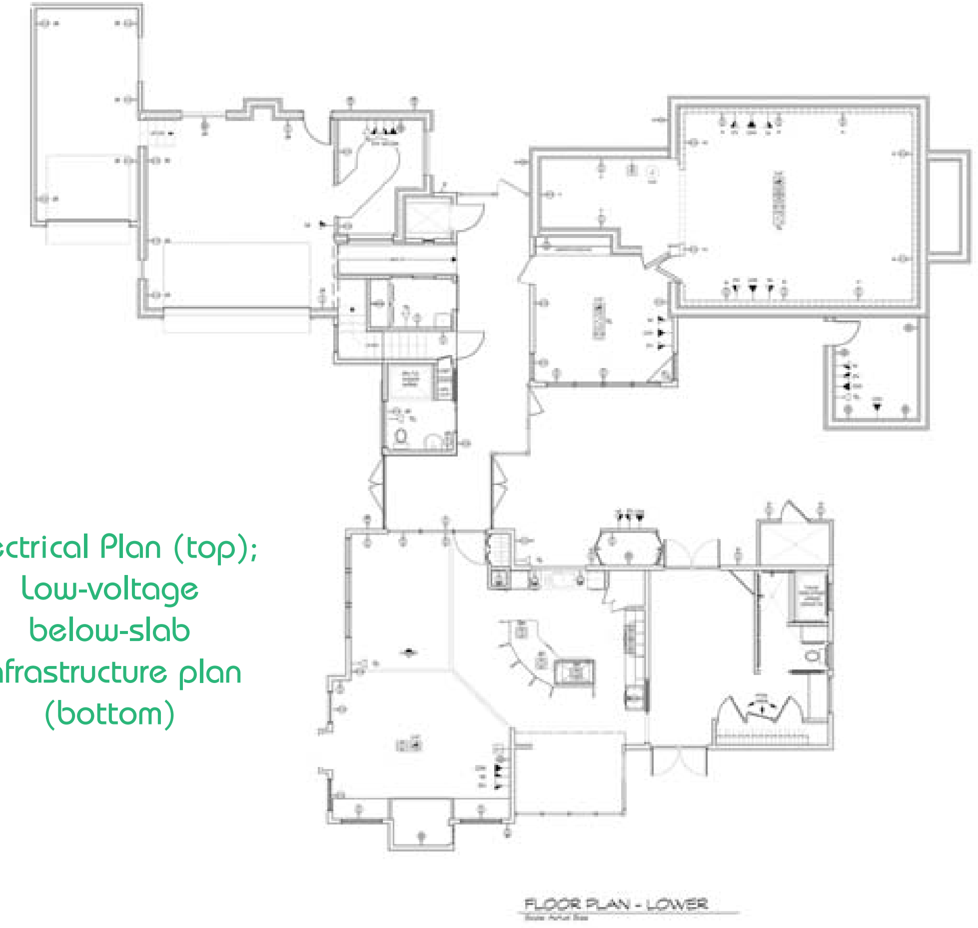
optimum performance home



Electrical Plan (top); Low-voltage below-slab infrastructure plan (bottom)

be posted on the *Ultimate Home Design* Web site (www.ultimatehomedesign.com/oph.php), depicting progress in the construction of the first Optimum Performance Home.

Design Concept

As previously noted in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how modern building products and methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes concerns itself with building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated and holistic design, the house will serve as a permanent residence that allows its occupants to age in place.

The high-performance building systems to be employed are designed to exceed California building code requirements and resist natural disasters more effectively than a code-minimum house, even with the new California code requirements that require use of non-combustible or fire ignition-resistant building materials. Constructed with stronger building materials and superior techniques, the home will be safer, allowing homeowners greater peace of mind. The Optimum Performance Home qualifies for the Fortified…For Safer Living® program of the Institute for Business & Home Safety (www.ibhs.org/business_protection). This program specifies construction,

Zurn® Flo-Thru Trench Drain

• The modular Zurn® molded-slop Flo-Thru trench drain is designed for load-bearing strength, hydraulics, chemical resistance, and structural integrity.

design, and landscaping guidelines to increase a new home's resistance to natural disaster.

In addition, the home will meet the guidelines and qualifications for the U.S. Department of Environmental Protection's ENERGY STAR®, the EPA's (Environmental Protection Agency) WaterSense™, and the American Lung Association® Health House® programs. It also will meet the requirements of the National Association of Home Builders' (NAHB) National Green Building Standard, the Sustainable Buildings Industry Council (SBIC) Green Building Guidelines, and the "Green Points" program. Sonoma County and The Sea Ranch Association are now considering this program for adoption.

Furthermore, the home's design was the subject of a case study analysis presentation before the Custom Residential Architects Network (CRAN), Full Spectrum Practice Convention of the American Institute of Architects on October 20, 2007 in Chicago, Illinois.

The home is also a case study of the California Energy Commission in terms of energy-efficiency applications and an advanced water-saving plumbing plan.

Finally, the home is a national showcase for CEDIA, and is the subject of a series of articles on the design and installation of the electronic lifestyle components in the home. These articles are featured in CEDIA's *Electronic Lifestyles*® quarterly magazine.

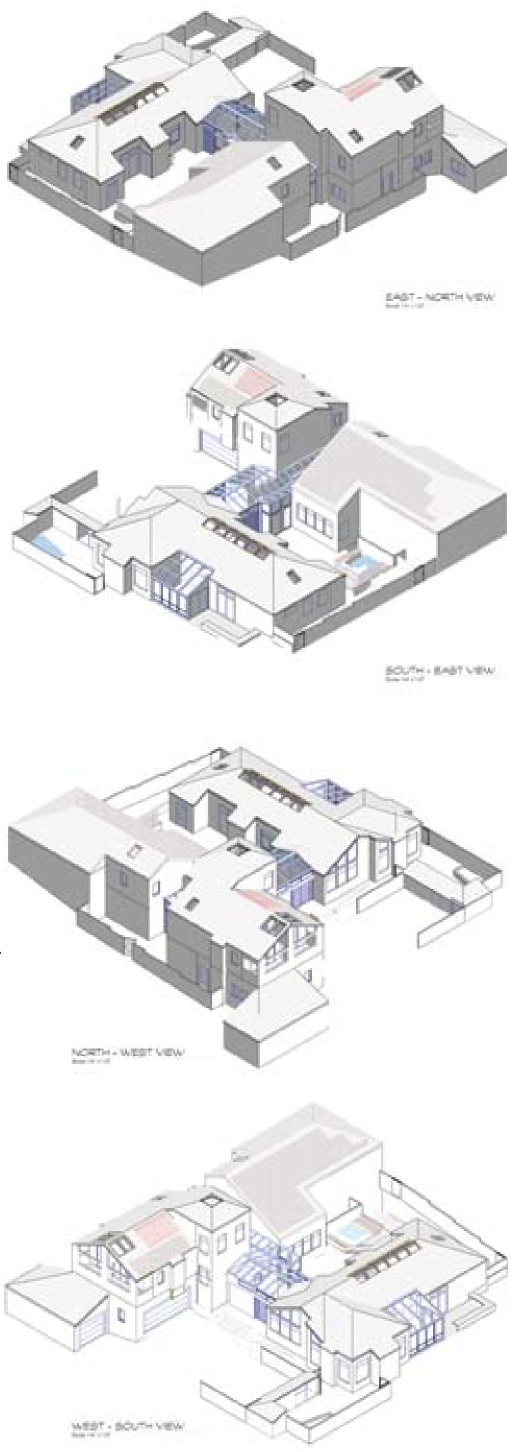
The Setting

The Sea Ranch is an internationally renowned 5,000-acre environmentally protective residential development situated within a pastoral and forested coastal enclave and nature preserve approximately 110 miles north of San Francisco, California. This stunning development, now celebrating its 43rd anniversary, straddles a ten-mile stretch of Highway 1 along a uniquely beautiful rugged coastline, ending at the northern tip of Sonoma County and the south bank of the Gualala River.

The Sea Ranch is widely regarded as a unique and remarkable residential development. During the 1960s and 1970s, The Sea Ranch was at the forefront of environmentally responsible development. It was conceived and designed by architects and landscape architects who wanted to provide a harmonious mixture of custom homes and pristine natural Northern California landscape in oceanfront, meadow, and forest environments. In fact, The Sea Ranch concept and its architecture are recognized in schools of architecture around the world, and it is frequently used for case studies in environmental and architectural design. The first condominium complex to be built on the southern coastal bluffs of The Sea Ranch is now a registered national architectural site.

Single-family development occupies approximately 2,500 acres without borderline fences or other visible delineation of property lines. The remaining acres are permanent green-scape commons with 45 miles of nature trails for walkers, bicyclists, and equestrians. Each home is custom designed by an architect/architectural designer following site-specific design guidelines and is situated off a private road network without curbs, sidewalks, or streetlights. The Sea Ranch is a very unique residential development woven into a tapestry of buildings and nature and committed to environmental preservation. The development includes 2,288 lots for single-family custom homes, with 529 remaining to be developed (1,735 already developed and 24 under construction).

The Sea Ranch is managed by The Sea Ranch Association, a Common Interest Development (CID) with an elected volunteer Board of Directors, and supported by numerous volunteer committees. All development on The Sea Ranch is subject to design review



Four perspective views of the Optimum Performance Home at The Sea Ranch

and the approval of a Board-appointed autonomous Design Committee. The Design Committee is presently comprised of architects and landscape architects, though it does not include anyone with experience in vegetation management or "green" sustainable building design. A legal set of Covenants, Conditions, and Restrictions (CC&Rs) govern the development and are designed to protect The Sea Ranch concept.

The Home

The Sea Ranch Design Committee imposes upon designers architectural building blocks derived from the original rural structures found on the northern California coast. Designers are expected to apply their creativity to render various arrangements and deviations to arrive at a custom solution that specifically responds to the site. Successful proposals submitted to the Design Committee address the issues of passive solar positioning, wind, glazing (window) layout, privacy between neighbors, vegetation protection, view preservation, topography and grade changes, roof slopes, appropriate exterior materials and finishes, and other exterior design considerations—all within the building and site design.

A focus of the Optimum Performance Home's design is to stand as a showcase for the "green" movement and demonstrate means of reducing a home's impact on the planet through the use of Low-Impact Development and environmentally responsible and sustainable building materials. It is hoped that the home will become a case study for a "Green Points Program" suited to the scale of The Sea Ranch.

The home's 3,272-square-feet living space (4,441-square-feet total building "footprint," including garages, covered walkways, courtyard, and decks) will be arranged in a three-building

compound using a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency. This arrangement provides for an alcove courtyard protected from the prevailing wind from the northwest. The home is designed with differing spatial experiences throughout to encourage exploration. The home will display innovative interior design and be furnished in a contemporary Frank Lloyd Wright style appropriate to its dimensions. The home design connects the indoors and the outdoors with covered walkways, a courtyard, decks, and a garden to expand livable space, without requiring heating or air conditioning. The home is designed in accordance with biophilic design principles with abundant and excellent use of natural light and natural indigenous landscaping planned. {For an in-depth analysis of the biophilic attributes of the home, please read “Biophilic Design,” “Biophilic Design Attributes,” and “The Interior Design Process, Part I: Synthesizing Sustainability, Universal Design, And Technology” authored by Julie Stewart-Pollack in Issue 3 (May/June 2006), Issue 4 (July/August 2006), and Issue 10 (July/August 2007), respectively.}

The main-floor living area is designed to accommodate the capabilities of all occupants without any challenging physical barriers, even for the elderly and disabled. The home design features a ground-level open plan for the living room, dining room, master bedroom suite, and spacious kitchen with solarium, exhibition cooktops, and home management system.

The second building in the compound is designed to accommodate a large state-of-the-art Optimum Performance Home Theatre with integrated rear-screen projection room and a home office.

The third building will include a two-car and boat garage, workshop, main-level guest bathroom, and laundry room. The second level of this building will have two guest bedrooms, a bathroom, and a dedicated library/home theatre/surround music room distinguished by a high-tower feature. To insure universal access to this floor, the design provides for an Otis® Gen2 residential elevator.

The entrance and walkways that connect the three buildings and the solarium will be enclosed with insulated- and solar gain-reduced-tempered glass. There will be a seating area at the vestibule entrance to the home. The main entrance vestibule will serve as an oversized mudroom. The driveway, area around the garage, guest parking, and entrance to the home—as well as all paths—are designed in accordance with The Sea Ranch guidelines governing exterior hard-surfaced paths. All such surfaces are pervious to virtually eliminate water runoff. The surface will be packed with decorative crushed rock to enhance the natural appearance of the home’s setting. There also will be a dedicated equipment room off the courtyard, which accommodates the Uponor and WaterFurnace radiant-heating apparatus, TrendSetter® solar hot water storage tanks, Navien’s 98 percent condensing on-demand propane-fired tankless water heater, and other equipment. The backup Kohler® generator is housed within a separate weather-resistant tower located off the north wall of the two-car garage and guest bedroom, within the fenced dog run. This tower is designed to optimize the northwest wind performance of the PacWind® Seahawk® vertical-axis Savarrieus™ wind turbine disguised within (see Part XII, November/December, Issue 12).

The home site is nestled on an almost-acre parcel at the edge of a forested area of the southern section overlooking the Pacific Ocean, offering distant water views. Some of the home’s features will include a Benissimo® slate-floor outdoor courtyard, two thick solid hardwood Ipé deck areas, in-ground Dimension One Spa® Amoré Bay hot tub, Finnelo® Finnish sauna, and underground wine cellar. The orientation of the home on the site is designed to take advantage of natural lighting and passive solar heating and cooling. Good site and land planning will result in minimal land disturbance and preservation of natural features and environments.

Landscaping will consist of The Sea Ranch-approved indigenous vegetation with low-water requirements and unique water conservation features, including two ponds and a stream supported by rainwater catchment and captured runoff. Site grading has been specifically planned to enhance the project’s placement in the watershed, and the design incorporates the principles of Low Impact Development to minimize runoff from impervious surfaces and mimic the natural hydrology in overall effect. The resultant water harvesting will then minimize the use of irrigation, and the increased infiltration and retention will passively support the native landscape. Additionally, a gray water system will be used for undersurface plant irrigation.

For more information on this advertiser, circle 06

Next

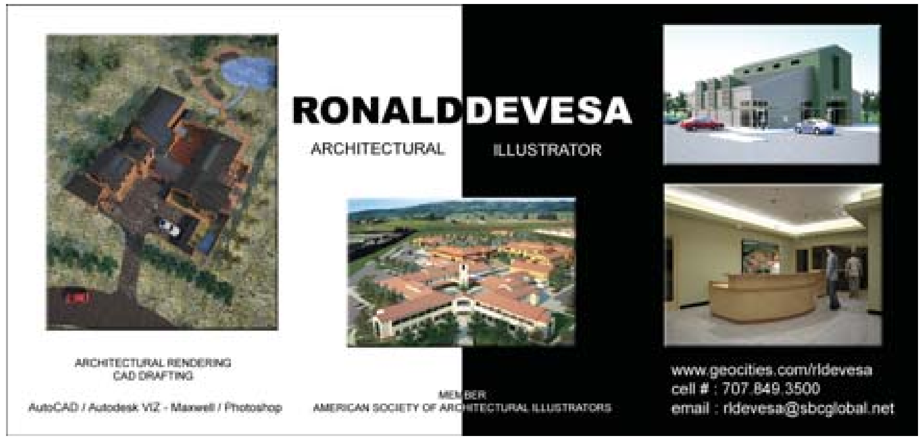
With site preparation and foundation construction well underway, this continuing series of articles will focus on the design elements as they pertain to each stage of construction as the project progresses, and will include coverage of the technologies and building systems and the materials used and applied to construct the first Optimum Performance Home. UHD

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-In-Chief and Publisher of *Ultimate Home Design*®, The Optimum Performance Design & Build Resource For Environmentally Enhanced Lifestyle Living™. He is also President of WSR Publishing, Inc, which publishes *Widescreen Review*®, The Essential Home Theatre Resource™. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics and architectural fields. Gary can be reached at 951 676 4914 or gary@ultimatehomedesign.com.

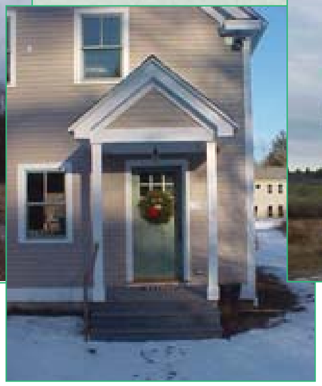
Product And Contact Information

- AFM Corporation, R-Control, 211 River Ridge Circle, Suite 102A, Burnsville, Minnesota 55337, 952 474 0809, www.r-control.com
- Amvic, Inc., 501 McNicoll Avenue, Toronto Ontario Canada M2H 2E2, 416 410 5674, www.amvicsystem.com
- Aqua Harvest International, 3628 Greystone Ridge Court, Rio Rancho, New Mexico 87124, 505 975 5008, www.aquaharvestonline.com
- Armacell LLC, 7600 Oakwood Street Extension, Mebane, North Carolina 27302, 800 866 5638, www.armacell.com
- Bartlett Mechanical Services, 6755 Oak Street, Anderson, California 96007, 408 313 2486, www.bartlettmechanical.com
- Bed Rock Concrete Pumping, P.O. Box 503, Point Arena, California 95468, 707 882 2637
- Bed Rock Products, Inc., 135 Hay Parkway, Point Arena, California 95468, 707 882 2323
- Bill Wilson Environmental Planning & Design, LLC, 71 Del Casa Drive, Mill Valley, California 94941, 415 383 2919, 805 689 7639
- Broan-NuTone, 926 West State Street, Hartford, Wisconsin 53027, 800 548 0790, www.nutone.com
- California Portland Cement Company, 2025 East Financial Way, Glendora, California 91741, 800 272 9119, www.calportland.com
- Conti Materials, P.O. Box 30248, Stockton, California 95213, 209 467 0626, www.contimaterials.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Beamsville, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- EchoStar DISH Network, 9601 South Meridian Boulevard, Englewood, Colorado 80112, 888 825 2557, www.dishnetwork.com
- Energy Edge, 7701 East Kellogg, Suite 722, Wichita, Kansas 67207, 316 618 1983, www.energyedgeform.com
- Engineered Environments, 1250 Marina Village Parkway, Alameda, CA 94501, 510 521 7500, www.engineeredenviornments.com
- Euclid Chemical Company, 19218 Redwood Road, Cleveland, Ohio 44110, 800 321 7628, www.euclidchemical.com
- Feeney Construction, 14660 McCourtney Road, Grass Valley, California 95945, 530 477 7647, 707 884 9458
- FORTA Corporation, 100 Forta Drive, Grove City, Pennsylvania 16127-6399, 800 245 0306, www.fortacorp.com
- GetWireless LLC, 10901 Red Circle Drive, Suite 325, Minnetonka, Minnesota 55343, 800 990 9025, www.getwirelessllc.com
- Hacker Industries, Inc., 610 Newport Center Drive, Suite 250, Newport Beach, California 92660, 800 642 3455, www.hackerindustries.com
- Headwaters Resources, 10653 South River Front Parkway, Suite 300, South Jordan, Utah 84095, 888 236 6236, www.flyash.com
- iBeam Systems, Inc., 280 North 8th Street, Suite 30, Boise, Idaho 83702, 800 403 0688, www.ibeamsystems.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- Mendocino Coast Plumbing, P.O. Box 41, Manchester, California 95459, 707 882 2628, 707 353 2628.
- Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, 847 966 6200, www.cement.org
- Seepage Control, 7301 West Boston Street, Chandler, Arizona 85226, 800 214 9640, www.seepagecontrol.com
- Smart Drain, Drawer 2219, Columbia, Maryland 21045, 800 638 8582, www.smartdrain.com
- Sonoma County Builders, Inc., 6280 Old Redwood Highway, Santa Rosa, California 95403, 707 837 2997 / P.O. Box 244, Point Arena, California 95468, 707 684 9144
- Spunstrand Incorporated, 620 North Post Street, Post Falls, Idaho 83854, 208 665 7444, www.spunstrand.com
- Steve Glaze Backhoe, 2766 Parkview Drive, Lakeport, California 95453, 707 263 3055
- Steve Michelson Productions, Lobitos Creek Ranch, 2800 Lobitos Creek Road, Half Moon Bay, California 94019-2547, 650 726 2460, www.lobitoscreekranch.com
- Stevenson Electric, 1340 Highway 4, P.O. Box 2642, Arnold, California 95223, 209 768 2100
- StormTech, 20 Beaver Road, Suite 104, Wethersfield, Connecticut 06109, 888 892 2694, www.stormtech.com
- Stormwater Solutions, LLC, 3940 Laurel Canyon Boulevard, Suite 856, Studio City, California 91604, 866 786 7690, www.stormh2osolutions.com
- ThermaSAVE/IHSN, Inc, 4002 Helton Drive, Florence, Alabama 35630, 256 766 3378, www.thermapanel.net
- Uponor North America, 5925 148th Street West, Apple Valley, Minnesota 85254, 800 321 4739, uponor-usa.com
- Wardflex, 2085 West Avenue 140th, San Leandro, California 94577, 415 971 1531
- WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com, www.stormh2osolutions.com
- Weeks Drilling & Pump Company, 6100 Highway 12, Sebastopol, California 95472, 707 823 3184, www.weeksdrilling.com
- WildBlue Communications, Inc., Greenwood Corporate Plaza, Building. 1, 5970 Greenwood Plaza Boulevard., Suite 300, Greenwood Village, Colorado 80111, 866 945 3258, www.wildblue.com
- Wonderwater, P.O. Box 1510, Mt. Shasta, California 96067, 530 926 5050, 530 925 2586, www.wonderwater.net
- Zurn Flo-Thru Operation, 116 Molly Rex Lane, Mooresville, North Carolina 28117, 704 799 7087, www.zurn.com



For more information on this advertiser, circle 07

Building One Of The First LEED®-Certified Homes In Massachusetts



Doug Storey

synopsis

- The USGBC is the nation's foremost coalition of leaders from across the building industry, working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work.
- The LEED® Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance sustainable buildings.
- Building a home that is smaller than the national average is one of the criteria for collecting points in the rating system.
- The Project Checklist includes eight categories: Location and Linkages, Sustainable Sites, Water Efficiency, Indoor Environmental Quality, Materials and Resources, Energy and Atmosphere, Homeowner Awareness, and Innovation and Design Process.

About a-year-and-a-half ago, I was contacted by a potential customer, Margie Lynch, who wanted to build a new home for herself on family property. To be more specific, she wanted to build a "green" home and for it to be LEED® (Leadership in Energy and Environmental Design) certified. She asked if I, as a design builder, was interested in attempting to guide her through the arduous LEED-certification process while building her home.

I told her I was interested in being her builder for several reasons: first, she was referred to us by a friend, and referrals often lead to the best customers; second, she wanted to build a custom home, which is our forte; and third, she wanted to build it "green," which we care deeply about. I also knew the challenge would lead to much learning, growth, and an opportunity to differentiate our company.

We were to be participating in the U.S. Green Building Council's (USGBC) LEED for Homes Pilot Demonstration. The USGBC is the nation's foremost coalition of leaders from across the building industry, working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work. The LEED Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance sustainable buildings.

Over several meetings and discussions about what Margie wanted and how she defined a "green" home, we came to a mutual point of trust and comfort. Margie hired Two Storey Building prior to the design and estimating stages. As a builder, this was the best time to get involved in the full spectrum of learning and knowledge to be gained from this project.

Margie's concerns included wanting to minimize the impact on the environment and her building lot, to build a small home, to make careful product and material selections, to minimize waste generated by the construction of the home to obtain ENERGY STAR® qualification as a minimum recognition of energy efficiency, and to ultimately achieve LEED certification for the home.

She had a simple two-story layout that she wanted incorporated into a finished Georgian-style home. We reviewed the layout and encouraged her to make some design changes that would maximize efficiency of the small floor plan. We suggested that she move the stairs to a center location to ensure an efficient use of space and a smooth flow from one floor to the others. She decided on an open floor plan of an entry foyer, dining room, living room, kitchen, and powder room on the first floor, and two bedrooms, a full bath, and a large walk-in closet that could later be converted to a third bedroom on the second floor. The attic had a pull-down stair and room for much storage and a heat recovery ventilation unit (HRV). The full basement would have a conditioned mechanical room, a laundry area, a bulkhead exit, and more room for storage or future growth.

The footprint was 24 x 26 feet, or 624 square feet per floor. It is pretty small by today's standards. In fact, it is less than half of the typical home built in 2006. This would be a critical component of the LEED certification. Building a home that is smaller than the national average is one of the criteria for collecting points in the rating system.

Not only was she willing to go smaller, but she also felt strongly that she didn't need some of the other features of a typical home, such as an attached garage, air conditioning, and an irrigation system. These too are features that must be addressed in the LEED certification process. Attached garages can lead to indoor air quality issues, air conditioning uses much energy and must be efficient, and irrigation uses much water. Margie eliminated these concerns right at the onset by choosing to forego them.

> "Much time was spent gathering and reviewing information into the sustainable building procedures and sustainable material selections."

Once we had the interior layout set, we began adding features to the exterior profile to achieve the Georgian style she sought. We incorporated large overhangs in the soffits, which also lessens solar heat gain in the summer months, built-out trim to allow for a rain screen behind the siding, a simple rear entry, and a more formal covered front entry with multiple layers of moldings. She took pictures of details she liked on houses she had seen, and we tried to simulate some of those looks through our own design process.

We carefully evaluated different framing options for the house. Margie was interested in looking into Structural Insulated Panels (SIPs) for framing. The panels are two layers of oriented strand boards (OSB) laminated to a core of expanded polystyrene (EPS) insulation. These panels provide an effective thermal resistance through increased R values of the panels (R 24 for a 6-inch wall), reduced air leakage due to its closed cavity design and sealing of all seams, and long-term structural integrity. The panels are manufactured in a factory setting and are installed much more quickly than traditional stick framing, with substantially less job site waste. Our LEED/ENERGY STAR provider, Conservation Services Group of Westborough, was very enthusiastic about the SIPs option and ran the two framing scenarios through their energy-modeling software. The SIPs' design was more energy

efficient under the model, but not substantially so. Margie's ultimate decision to go with SIPs was primarily based on the reduced job site waste, despite the extra cost to go this route (27 percent, see below).

Once the design concept was formulated, we sent it to Panel Pros of Keene, New Hampshire. After a review of several Structural Insulated Panel (SIPs) manufacturers, we had selected Panel Pros as our SIP partner. In addition to producing our frame, they did all of the structure engineering necessary to transform our design into plans that could be built out of their product. This also allowed us to avoid the use of an architect at a substantial additional cost. We would use 6-inch thick panels for the walls and 8-inch thick panels for the roof.

Having finalized the design, we moved on to educating ourselves about the LEED rating system and the process by which it would be implemented. The LEED certification process was started by our

Milestone	Start	Finish
Initial Meetings with Homeowner and Builder	Fall 2005	
Meetings with CSG, Partners	December 2005	April 2006
LEED Research & Home Design	Fall 2005	Summer 2006
Break Ground	March 2006	
Actual Construction of House	April 2006	October 2006
LEED Certification Timeframe	October 2006	February 2007

meeting with Conservation Services Group, Inc., the local consulting and review nonprofit partner for the LEED program and a review of LEED guidelines. A Project Checklist was filled out to determine categories in the development process for inclusion in the program rating system. This checklist includes eight categories: Location and Linkages, Sustainable Sites, Water Efficiency, Indoor Environmental Quality, Materials and Resources, Energy and Atmosphere, Homeowner Awareness, and Innovation and Design Process. The builder must also fill out a detailed Durability Checklist to determine building practices that will work toward the program goals.

Our home was to be built in a relatively rural area, so some of the checklist items that relate to more urban construction were not applicable. We could not achieve points for compact housing density or even being close to existing municipal sewer and water. We were sited within one-half mile of green spaces, and we did minimize the disturbed area of the site, despite having to put in a septic system and well. We installed fencing clearly demarking "no disturb areas." We did not touch over 66 percent of the site.

LEED for HOMES

Durability Checklist

Builder Name: Two Storey Building
Address of LEED Home (Street, City, State): Lot D-2 Boxborough Rd. Stow MA

Project-Specific Site, Environmental, & Building Information

1. Site (briefly describe the following)
Site & surrounding terrain: Field and pasture, apple orchard in the distance, homes in the viscinity
Type of soil: Good loam, then gravel and sand
Depth of soil (to bedrock): Deep
Depth of ground water below structure: 94" Other Significant Features:
Level/type(s) of pest threat: Low
EPA Radon Zone: 1 (1, 2, or 3) http://www.epa.gov/iaq/radon/zonemap.html

2. Home & Occupancy
Conditioned floor area: 1248 (square feet) Stories: 2 Garage: attached/detached/none? None
Number of bedrooms: 3 Number of bathrooms: 1.5 Full-time/vacation home? Full time
Structure (wood, etc.): Wood structural insulated panels Building type (SF, MF, attached/detached, etc.): SF

3. Meteorological
ENERGY STAR Climate Zone: N (N, NC, SC, S) http://www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows#map
Annual rainfall: 40-50 inches per year
LEED Precipitation Zone: Wet (Normal, Dry, Wet) http://gis.ncdc.noaa.gov/website/ims-climatls/index.html
Average annual wind speed: 9 to 9.9 mph Annual max.: same as above
Average annual solar insolation: 2 to 3 KWh/M²/day 5630 HDD, 777 CDD http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/colorpdfs/13.PDF

4. Potential Natural Disasters
☐ Hurricane ☐ Wildfire ☐ Earthquake
☐ Tornado ☐ Flood ☐ Other, specify:

Durability Risk Factors: Assignment of Priorities

For each of the following issues, indicate whether, for this project, there are high, moderate, or low/no durability concerns:

	H / M / L		H / M / L		H / M / L
Water -- exterior sources	L	Heat flow	L	Other (list):	
Water -- interior sources	L	UV (solar) radiation	L		
Water vapor flow	L	[illegible]	[illegible]		
Air flow	H				

Team Expertise

Core Skills of Team: Check to indicate greater than 5 yea[illegible]
☐ Architecture
☐ Energy systems design (including HVAC)
☐ Energy / green ratings
☐ Indoor air quality

Sign-offs (to be filled in after completio[illegible]

Sign-off by Builder's Site Supervisor

I hereby declare and affirm to USGBC that each [illegible]
listed above (in the Builder's durability plan) has [illegible]
Date:
Contractor Name:
Signature:
Site Foreman:
Signature:

US Green Building Council

Building Item	Conventional Cost	Green Cost	Difference	% Diff.
LEED Fees	NA	$2,025.00	$2,025.00	100%
House Framing—Using SIPS	$31,250.00	$42,740.48	$11,490.48	27%
Green Insulation	$2,000.00	$2,200.00	$200.00	9%
Plastic Recycled Lumber For Decks	$1,000.00	$2,196.84	$1,196.84	54%
FSC-Certified Lumber	$2,000.00	$2,835.00	$835.00	29%
Radiant Heat versus Baseboard	$6,000.00	$8,380.00	$2,380.00	28%
Locally Harvested Pine Flooring	$3,100.00	$3,587.52	$487.52	14%
Waste Removal	$1,300.00	$1,096.35	($203.65)	16%
Homeowner Paid				
Item Totals	$46,650.00	$65,061.19	$18,411.19	28%
Total Budget Increase				5.7%
Homeowner Paid				
Project Mgmt Time for LEED Process	NA	$6,500.00	$6,500.00	100%
Based on estimate of 100 additional hours				

LEED for HOMES

Project Checklist

Builder Name: Doug Storey, Two Storey Building
Address (Street/City/State): 89 Spectacle Hill Road, Bolton, MA

Detailed information on the measures in the checklist below are provided in the companion document "LEED for Homes Rating System"

Yes	?	No	#	Credit	Measure	OR	Dry	Normal (Maximum Points [2])	Wet
				Location and Linkages (LL)		OR		10	
			1	LEED-ND Neighborhood		LL2-5		10	
			2	Site Selection	Avoid Environmentally Sensitive Sites and Farmland	LL1		2	
			3.1	Infrastructure	Site within 1/2 Mile of Existing Water, Sewer, and Roads	LL1		1	
			3.2		Select an Infill Site	LL1		1	
			4.1	Community Resources	Within 1/4 mile of Basic Community Resources / Public Transportation	LL1		1	
			4.2		OR Within 1/4 Mile of Extensive Community Resources / Public Transportation	LL1		2	
1			4.3		AND/OR Within 1/2 Mile of Green Spaces	LL1		1	
			5.1	Compact Development	Average Housing Density >/= 7 Units / Acre	LL1		1	
			5.2		OR Average Housing Density >/= 10 Units / Acre	LL1		2	
			5.3		OR Average Housing Density >/= 20 Units / Acre	LL1		3	
1				Sub-Total					
				Sustainable Sites (SS)				14	
Y			1.1	Site Stewardship	Minimize Disturbed Area of Site (If Site > 1/3 Acre)			Mandatory	
Y			1.2		Erosion Controls (During Construction)			Mandatory	
Y			2.1	Landscaping	Basic Landscaping Design			Mandatory	
1			2.2		Apply 3 to 4 Inches of Mulch Around Plants			1	
1			2.3		Limit Turf		5	3	1
1			2.4		Minimize Landscape Water Demand		3	2	1
			3	Shading of Hardscapes	Locate and Plant Trees to Shade Hardscapes			1	
Y			4.1	Surface Water Management	Install Permeable Material for at Least 65% of Lot (If Lot >/= 1/4 acre)			Mandatory	
5			4.2		Use Permeable Paving Materials		1	3	5
			4.3		Design and Install Permanent Erosion Controls		1	2	3
1.5			5	Non-Toxic Pest Control	Select Insect and Pest Control Alternatives from List			2	
9.5				Sub-Total					
				Water Efficiency (WE)				12	
			1.1	Water Reuse	Rainwater Harvesting System			1	
			1.2		Grey Water Re-Use System			1	
Y			2.1	Irrigation System	Main Shutoff Valve, Sub-Meter, and Third-Party Inspection			Mandatory	
			2.2		Select High Efficiency Measures from List		5	3	1
			2.3		Rain Sensing Controls			1	
1			3.1	Indoor Water Use	High Efficiency Fixtures (Toilets, Showers, and Faucets)			3	
			3.2		OR Very High Efficiency Fixtures (Toilets, Showers, and Faucets)			6	
1				Sub-Total					
				Indoor Environmental Quality (IEQ)		OR		14	
			1	ENERGY STAR with IAP	Meets ENERGY STAR w/ Indoor Air Package (IAP)	IE2-10		10	
Y			2.1	Combustion Venting	Space Heating and DHW Equip w/ Closed/Power-Exhaust; & CO Monitor	IE1		Mandatory	
Y			2.2		Fireplaces w/ Outside Air Supply and Closed Combustion	IE1		Mandatory	
			3	Humidity Control	Analyze Moisture Loads AND Install Central System (where Needed)	IE1		1	
Y			4.1	Outdoor Air Ventilation	Meets ASHRAE Std 62.2	IE1		Mandatory	
2			4.2		Dedicated Outdoor Air System (w/ Heat Recovery)	IE1		2	
1			4.3		Third-Party Testing of Outdoor Air Flow Rate into Home			1	
Y			5.1	Local Exhaust	Meets ASHRAE Std 62.2	IE1		Mandatory	
1			5.2		Timer / Automatic Controls for Bathroom Exhaust Fans	IE1		1	
1			5.3		Third-Party Testing of Exhaust Air Flow Rate Out of Home			1	
Y			6.1	Supply Air Distribution	Meets ACCA Manual D	IE1		Mandatory	
2			6.2		Third-Party Testing of Supply Air Flow into Each Room in Home			2	
Y			7.1	Supply Air Filtering	>/= 8 MERV Filters, w/ Adequate System Air Flow	IE1		Mandatory	
			7.2		>/= 10 MERV Filters, w/ Adequate System Air Flow			1	
			7.3		OR >/= 12 MERV Filters, w/ Adequate System Air Flow			2	
Y			8.1	Contaminant Control	Seal-Off Ducts During Construction	IE1		Mandatory	
			8.2		Permanent Walk-Off Mats *OR* Central Vacuum			1	
			8.3		Third-Party Testing of Particulates and VOCs before Occupancy			1	
Y			9.1	Radon Protection	Install Radon Mitigation System if Home is Located in EPA Region 1	IE1		Mandatory	
			9.2		Install Ground Contaminant Mitigation System (Outside of EPA Region 1)	IE1		1	
Y			10.1	Vehicle Emissions Protection	No Air Handling Equipment OR Return Ducts in Garage	IE1		Mandatory	
Y			10.2		Tightly Seal Shared Surfaces between Garage and Home	IE1		Mandatory	
1			10.3		Exhaust Fan in Garage OR No Garage in Contact with Home	IE1		1	
8				Sub-Total					
				Materials and Resources (MR)				24	
3			1	Home Size	Home that is Smaller than National Average			10	
Y			2.1	Material Efficient Framing	Overall waste factor for framing order shall be no more than 10%.			Mandatory	
1.5			2.2		Advanced Framing Techniques			2	
2.0			3	Local Sources	Materials Extracted / Manufactured / Produced within 500 Miles			3	
Y			4.1	Durability Plan	Detailed Durability Plan; (Pre-Construction)			Mandatory	
5			4.2		Third-Party Verification of Implementation of Durability Plan		1	3	5
Y			5.1	Environmentally Preferable	Tropical Hardwoods, if used, must be FSC			Mandatory	
4			5.2	Products	Select Environmentally Preferable Products from List			4	
Y			6.1	Waste Management	Max of 2.5 Lbs Per Square Foot of Construction Waste Sent to Landfill			Mandatory	
1.5			6.2		0.5 Pts for Each Additional 0.5 Lbs Per Square Foot Reduction			2	
17				Sub-Total					
				Energy and Atmosphere (EA)		OR		29	
Y			1.1	ENERGY STAR Home	Meets ENERGY STAR for Homes with Third-Party Testing			Mandatory	
12.5			1.2		Exceeds ENERGY STAR for Homes, 2 Pts Per HERS Point > HERS 86	EA2-7		16	
Y			2.1	Insulation	Third-Party Inspection of Insulation Installation, At Least HERS Grade II	EA1		Mandatory	
			2.2		Third-Party Inspection of Insulation Installation, At Least HERS Grade I	EA1		1	
			2.3		OR Above Code Insulation; At Least 5% > Local Code Per REScheck	EA1		1	
Y			3.1	Air Infiltration	Third-Party Envelope Air Leakage Tested </= 0.35 ACH	EA1		Mandatory	
			3.2		Third-Party Envelope Air Leakage Tested </= 0.25 ACH	EA1		1	
			3.3		OR Third-Party Envelope Air Leakage Tested </= 0.15 ACH	EA1		2	
Y			4.1	Windows	Windows Meet ENERGY STAR for Windows (See Table)	EA1		Mandatory	
			4.2		Windows Exceed ENERGY STAR for Windows by >/= 10% (See Table)	EA1		1	
			4.3		OR Windows Exceed ENERGY STAR for Windows by >/= 20% (See Table)	EA1		2	
Y			5.1	Duct Tightness	Third-Party Duct Leakage Tested </= 5.0 CFM25 / 100 SF to Outside	EA1		Mandatory	
			5		Third-Party Duct Leakage Tested </= 3.0 CFM25 / 100 SF to Outside	EA1		1	
			5.3		OR Third-Party Duct Leakage Tested </= 1.0 CFM25 / 100 SF to Outside	EA1		2	
Y			6.1	Space Heating and Cooling	Meets ENERGY STAR for HVAC w/ Manual J & refrigerant charge test	EA1		Mandatory	
			6.2		Exceeds ENERGY STAR for HVAC by >/= 10%, w/ Manual J	EA1		1	
			6.3		OR Exceeds ENERGY STAR for HVAC by >/= 20%, w/ Manual J	EA1		3	
			7.1	Water Heating	Improved Hot Water Distribution System			3	
			7.2		Improved Water Heating Equipment	EA1		3	
			8.1	Lighting	Energy Efficient Fixtures and Controls			1	
			8.2		OR ENERGY STAR Advanced Lighting Package			3	
2			9.1	Appliances	Select Appliances from List			2	
			9.2		Very Efficient Clothes Washer (MEF > 1.8, *AND* WF< 5.5)			1	
			10	Renewable Energy	Renewable Electric Generation System (1 Point / 10% Annual Load Reduction)			6	
1			11	Refrigerant Management	Minimize Ozone Depletion and Global Warming Contributions			1	
15.5				Sub-Total					
				Homeowner Awareness (HA)				1	
Y			1.1	Homeowner Education	Basic Owner's Manual and Walkthrough of LEED Home			Mandatory	
1			1.2		Comprehensive Owner's Manual and Multiple Walkthroughs / Trainings			1	
1				Sub-Total					
				Innovation and Design Process (ID)				4	
		x	1.1	Innovative Design	Use of SIPs			1	
		x	1.2		radiant heating			1	
		x	1.3		rain screen cladding system			1	
			1.4		Provide Description and Justification for Specific Measure			1	
0				Sub-Total					
53.0	0	0		**Project Totals [1] (pre-certification estimates)**				108	

Notes: 1. **Certified** 30-49 points **Silver** 50-69 points **Gold** 70-89 points **Platinum** 90-108 points
2. "Points" are shown for 3 precipitation zones: Dry (< 20 inches / year); Normal (20-40 inches / year); and Wet (> 40 inches / year)

By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been met for the indicated credits and will, if audited, provide the necessary supporting documents (drawings, calculations, etc.).
Rater's Name ______ Company ______
Signature ______ Date ______

By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been met for the indicated credits and will, if audited, provide the necessary supporting documents (drawings, calculations, etc.).
Provider's Name ______ Company ______
Signature ______ Date ______

Landscaping requires limiting turf and water demand. Our site was a former apple orchard, and we decided to leave the wild field grass, install a permeable gravel driveway with no pavement, and not install any sprinkler systems. We also would install a rainwater barrel for harvesting precipitation for any necessary irrigation.

We also received points for our indoor air quality. This would include automatic timer controls for the bathroom exhaust fans, and outdoor air ventilation and supply air distribution with an HRV system. A radon protection system was a mandatory element of the LEED certification for our region.

Siding would be installed over a rain screen by running vertical strapping underneath and allowing for water drainage through weep holes in the bottom.

Windows and doors would have superior U values and added Low E coatings on the Argon gas-filled double-pane glass. The windows were ENERGY STAR labeled.

Margie had asked to include in our contract that ENERGY STAR-labeled items would be selected whenever they were an option. As a result, we installed ENERGY STAR thermostats, ceiling fans, dishwasher, refrigerator, clothes washer, and compact fluorescent light bulbs.

We also would install a high-efficiency (94 percent) Buderus propane boiler for the heating system using an under-floor radiant heat distribution throughout the house, and programmable thermostats. The radiant heat industry claims this system is 25 percent more efficient than typical heating systems. A super-insulated super storage tank would supply the hot water.

Water conservation was addressed through the purchase of ultra low-flow toilets (1.1 and 1.4 gpf), an aerator on the bathroom faucet, and a low-flow showerhead (1.5 gpm).

Material selections were critical to the process. We would use materials that are Forest Stewardship Council (FSC) certified (all interior millwork) and locally produced white pine flooring, 100 percent recycled plastic lumber for the deck and porch (made of HDPE [high-density polyethylene] from recycled milk cartons), cellulose and formaldehyde-free insulations, and low-VOC (Volatile Organic Compounds) paints and finishes. The counters came from recycled bowling land material that had been stored in a barn for years and resemble maple butcher block when finished.

One of the biggest challenges facing the builder

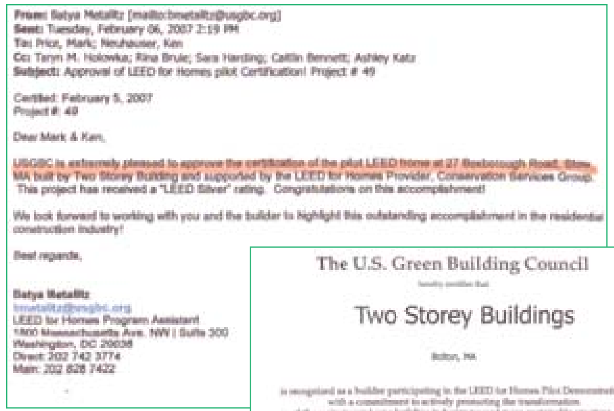
was a requirement that the waste from this project that was to be sent to a landfill not exceed three pounds per square foot of building space. This is less than half of the amount generated in a typical new house construction project. Through careful research, the Institution Recycling Network (IRN) of Concord, New Hampshire was identified as the recycling and waste removal partner for this project. Also, all subcontractors were required to recycle their applicable waste. We held planning meetings and printed recycling signage that was posted on the job site. We set up labeled recycling bins on site. We separated cardboard, metal, gypsum, wood, and other waste. The detailed waste-reduction report compiled by IRN showed that 94 percent of the construction waste on this project was recycled, including 100 percent of the gypsum waste.

Cost consideration is a hot topic in "green" building. Significant systems, such as geothermal heating and photovoltaic power, cost considerably more initially and offer a payback in energy savings over their lifetimes. Our project did not incorporate either of these systems, as the budget would not allow it, although we did consider and research photovoltaic systems and solar hot water generation, both for domestic hot water and space heating.

We did make some material selections that had added costs. I tracked the cost of the major additional costs and compared them to conventional costs. I determined the added cost was 5.7 percent more on the total cost of the home, including the LEED certification fees. I think most homeowners will gladly pay 5 to 10 percent more for a better product. It does cost more, but it doesn't have to be an inordinate amount.

We actually built the house in our normal six-month time frame, but it took several months on the front end for planning, and several more on the back end for the approvals to come through from the rating consultants.

From the builder's perspective, this


From: Batya Metalitz [mailto:bmetalitz@usgbc.org]
Sent: Tuesday, February 06, 2007 2:19 PM
To: Price, Mark; Neuhauser, Ken
Cc: Taryn M. Holowka; Rina Brule; Sara Harding; Caitlin Bennett; Ashley Katz
Subject: Approval of LEED for Homes pilot Certification! Project # 49

Certified: February 5, 2007
Project #: 49

Dear Mark & Ken,

USGBC is extremely pleased to approve the certification of the pilot LEED home at 27 Boxborough Road, Stow, MA built by Two Storey Building and supported by the LEED for Homes Provider, Conservation Services Group. This project has received a "LEED Silver" rating. Congratulations on this accomplishment!

We look forward to working with you and the builder to highlight this outstanding accomplishment in the residential construction industry!

Best regards,

Batya Metalitz
bmetalitz@usgbc.org
LEED for Homes Program Assistant
1800 Massachusetts Ave. NW | Suite 300
Washington, DC 20036
Direct: 202 742 3774
Main: 202 828 7422

was a rewarding and enlightening learning experience. Much time was spent gathering and reviewing information into the sustainable building procedures and sustainable material selections. Also, many of our subcontracting partners embraced this new approach.

Two Storey Building grew tremendously through the process of completing this LEED-certified home. This project has resulted in some new standard procedures for our company on all future projects. It was certified LEED Silver, the first home so certified in Massachusetts, and ENERGY STAR 5 plus with a HERS Index of 59. Margie reports that she uses approximately 175 kilowatt hours of electricity per month and an average of 34 gallons of propane per month over the course of the year. These amounts are significantly lower than the average home.

It was one of the first residential LEED-certified projects in Massachusetts, and our final checklist showed that we achieved the following points in the rating system:

• Building within one-half mile of green spaces.

• Limiting turf and water demand.

3. Permeable paving materials and installing erosion controls.

• Non-toxic pest control measures.

• High-efficiency fixtures, including low-flow toilets and water-restricting devices.

• Including a heat-recovery ventilation system and automatic timers on the bathroom exhaust fans.

• Third-party testing of indoor air quality.

• No garage in contact with the home.

• Home that is smaller than national average.

• Advanced framing techniques.

• Waste reduction.

• Utilizing materials produced within 500 miles of the site.

• Third-party verification of the durability plan.

• Use of FSC-certified, reused, and

• ENERGY STAR home rating below national averages.

• ENERGY STAR appliances.

• No ozone depletion from AC sources.

• Comprehensive owner's manual, walkthrough, and training on systems.

We achieved LEED Silver with 53 points, and we did it at a reasonable cost. It did cost more, but not an exorbitant amount. While many "green" building practices do cost more in the short run, many will also more than pay for themselves over time as a result of higher energy efficiency. We built the home in a normal time frame, although the rating process did take a while longer. Our customer, Margie Lynch, has the home she wanted, built using sustainable practices, and at a reasonable cost.

Most importantly, we partnered together, builder and homeowner, to do our part to build better, utilize the latest and best building technologies and practices, and create a healthy home environment that is sensitive to its impact on our community and our world. We enjoyed the process and learned to be a better builder along the way. That is what I call a win-win! **UHD**

The Author

Doug Storey is the Managing Partner of Two Storey Building, a custom builder from Bolton, Massachusetts. Two Storey Buildings constructs custom homes and fine remodeling projects in the greater metropolitan Boston area. Doug Storey is a member of the NAHB; the Builder's Association of Greater Boston (BAGB), the Custom Building and Remodeling Council, and the Sustainable Building Committee of BAGB and has been published in *Journal Of Light Construction* and *Remodeling Magazine*, among other publications. He is a member of the Bolton Planning Board and a founder of the Bolton Affordable Housing Partnership. Doug can be reached at 617 438 0313 or destorey@comcast.net / www.twostoreybuilding.com.

Universal Design Makes Life Easier For Everyone

Susan Mack

Ergonomic principles of joint protection in raised front opening washer and dryer with front controls

Human-centered universal design enhances quality of life by reducing hazards, increasing comfort and convenience, welcoming people of all ages and abilities, accommodating human differences, and supporting our desire to stay in our homes indefinitely.

"An ounce of prevention is worth a pound of cure!" Just as the health care industry is promoting "preventive medicine," the universal design concept is promoting "preventive architecture"! You may wonder how architecture could be "preventive." Incorporating the Principles of Universal Design in products, homes, and communities reduces unnecessary hazards and barriers to healthy living.

Universal design homes and communities incorporate no-step walkways, entries, and showers. These features reduce the risk of trip and fall injuries. Falls are the leading cause of injury-related deaths in people over the age of 65. The direct medical costs for fall-related injuries in people over the age of 65 in the U.S. in 1994 were $20.2 billion dollars. The cost is projected to be $32.4 billion by the year 2020. This does not even address the severe pain and suffering resulting from fall-related injuries. Approximately half of the people who are hospitalized for fall-related injuries do not return to independent living.

All people are at risk of slip-fall injuries in the bathroom where soap and water create slippery floor surfaces. By installing safety handrails and slip-resistant floor coverings, we create safer bathrooms for everyone. Be PROACTIVE; install these safety features BEFORE a loved one is injured!

Have you noticed how many new products are now manufactured with wheels to reduce your need to carry heavy items? Having wheel-friendly homes and

Val seated at kitchen sink on high stool.

Fallsgrove Master Shower Professional illustrates no-step shower entry and safety handrail.

Kitchen Sink with wheelchair

communities allows you to use roll-on luggage, baby strollers, grocery carts, and furniture dollies. Why carry heavy things when you can roll them along effortlessly? We are living longer than ever before. We are putting more miles on our bodies, so we need to reduce the repetitive stress to our backs and joints. Over 110 million Americans report back pain. Universal designed homes incorporate the ergonomic principles of joint protection to make homes more comfortable.

We all are busy with family, community, and work-related responsibilities. Making life easier is an attractive benefit of universal design for everyone. Universal design consultants collaborate with architects to create homes that are more work efficient to reduce the personal energy required to complete activities of daily living, which leave more time and energy to participate in other creative and social activities.

Universal design is about enhancing abilities. People differ in their abilities. Some are strong, some are not so strong; some are tall, some are small; and some need to use assistive equipment. Our abilities change throughout our lifetimes. Universal designed homes welcome all of our friends and family regardless of age and abilities. No one is excluded from family gatherings because of unnecessary barriers.

We all cherish being masters of our own destiny. Universal design homes support "freedom of choice" of where we want to live. AARP (American Association of Retired Persons) surveys indicate that 89 percent of their members 45 years and older want to "age in place" in the comfort and convenience of their own homes. However, traditionally designed homes are fraught with unnecessary barriers and hazards. Universal design homes make traditionally designed homes obsolete. Why would anyone want to buy a home that would compromise his or her safety, health, and freedom of choice?

The Author
Susan Mack, OTR/L, CAPS, CAASH
NBCOT California Licensed Occupational Therapist
National Association of Home Builders—Certified Active Adult Specialist in Housing
National Association of Home Builders—Certified Aging in Place Specialist (CAPS)

As an Occupational Therapist for over 30 years, Susan Mack has been involved with modifying products and homes for people of all ages and abilities. When consulting with developers, builders, architects, remodeling contractors, and interior designers, she utilizes her knowledge of human functional diversity and changes over the lifetime to synthesize the principles of universal design into marketable universal floor plans and specifications. She received the 2001 and 2004 Gold Awards from the National Association of Home Builders for her consulting work on universal design homes in California and Ohio and was a finalist in the new 2007 AARP/NAHB Livable Communities competition for her consulting work on UD homes in Illinois. She is the universal design consultant for the Optimum Performance Home® at The Sea Ranch, California. She can be reached at 760 409 7565 and smack@homesforeasyliving.com and www.homesforeasyliving.com.

Photo Credit
Susan Mack, ©Homes for Easy Living Universal Design Consultants

Kolbe Contributes Windows And Doors For An Accessible, Comfortable Model Home

Heather West

It's an uncomfortable thought, but the longer we live, the more likely we are to develop physical limitations. In fact, one out of six Americans will experience a major disability during their lifetime. And it's no secret that America is aging significantly: By 2012, there will be more people age 65+ than in all the other age categories combined. These figures make it easy to see the growing need for universally accessible living accommodations that enable people to live independently.

Surprisingly, the burgeoning consumer need for accessible housing has not resulted in a proliferation of accessible single-family residences. It was this very absence that prompted Wayne Geurink and his nonprofit group, Chairs and Cares, to develop a demonstration model accessible home in Wausau, Wisconsin.

Officially opened in October, the Chairs and Cares Model Accessible Home was designed by Roger Plamann, an architectural instructor at Wausau's Northcentral Technical College (NTC), with input from a 16-person advisory board. General contractor Keller Builders started construction on the $1.2 million project, which is on the college's campus, in Spring 2006. The prototypical residence is operated by Midstate Independent Living Consultants, a nonprofit agency that serves people with disabilities in north-central and northeastern Wisconsin.

Virtually all of the model home's design elements and building components were donated. Committed to the project from its earliest stages, Kolbe & Kolbe Millwork Co. contributed 51 windows and 21 interior doors and entry doors. "Kolbe was the very first contributor to sign on to the project," says Geurink. "We were very impressed with their enthusiasm and commitment, and their superior products provide the design and operation flexibility that accessible design demands," says Geurink.

"Wayne and his team have done an outstanding job with this model accessible home," praises Mike Salsieder, president of Kolbe & Kolbe. He comments that "as an organization, Kolbe is sensitive to the fact that there are many people with physical limitations and that a significant portion of our population is aging. We were privileged to be able to work with Wayne and members of NTC, as well as other companies in our area, to help provide a facility that showcases a construction that allows people with physical limitations to live independently within a residential setting."

The entire residence serves as a showcase where people with physical disabilities or limitations, and others interested in accessibility, can experience accessible living design, see innovative adaptive equipment and technology solutions, and obtain information about building modifications, equipment, furniture, fixtures, and appliances.

"Our vision is to have the Chairs and Cares Model Accessible Home be successful enough to influence other parts of the country to develop similar properties," says Geurink.

"This facility serves as a basis to provide builders, architects, and homeowners throughout the region with an opportunity to incorporate innovative ideas into their own construction plans," Salsieder continues. "My wife, Mary, is an occupational therapist and a member of the Chairs and Cares Board. She has often impressed upon me the importance of understanding the difficulties that people with physical limitations face every day."

The project has already made an impression on at least one builder: Lewis Reeves, president of Lewis Reeves Homes in Atlanta, says, "I've been building houses for 30 years. Until I met Wayne, I had no idea where I'd turn—professionally or personally—to help someone with a physical disability to live as comfortably and independently as possible." Reeves is also president of Coan Millworks, a distributor of Kolbe windows and doors, which are often featured in his clients' high-end, custom homes.

Intrigued by its residential customization, Reeves followed the development of the Chairs and Cares Model Accessible House from design through completion. "It's a great concept, and there's such a need for this. There ought to be one in every city across the country. Wayne's example is truly inspiring."

A retired Wausau Insurance executive, Geurink had suffered paralyzing injuries from a car accident in 1991. In 2001, the idea for the Chairs and Cares Model Accessible Home came to him during discussions among members of a spinal cord injury group in which someone would inevitably say, "Wouldn't it be nice if there was a place where people could see, or get information about accessible housing?" He discovered that there wasn't a single example of a universally designed accessible residence in the central Wisconsin area: "I felt very strongly that this area needed a demonstration home that would highlight ways for people to keep their independence if they become disabled, or as they age or become less agile." The home is also intended to give architects and builders ideas about what can be done to make new homes or remodeled homes more functional for people with physical limitations.

"No matter what the situation, it would feel overwhelming to have to figure out an independent living solution, especially if you're faced with a combination of circumstances such as being in a wheelchair and having sight or hearing impairments," says Reeves. "I certainly have the structural know-how, but without the Chairs and Cares' example, it would take a lot of trial and error to provide the best and safest accommodations. And it's one thing to try to address these challenges through new construction, but adapting and renovating an existing home would be a much more difficult undertaking."

"Surveys show that most of us want to remain in our own homes as we age; enabling more people to live on their own for as long as possible means huge dollar savings for individuals, families, and for society as a whole," says Geurink. Underscoring his point are statistics from AARP (American Association of Retired Persons) showing that in 2006, the average annual cost for nursing home care in the U.S. was $68,800.

Homeowners, builders, and architects are not the only ones taking note of this. This past summer, 90 members of the Occupational Health Nurses Organization visited the model home. Those touring the Chairs and Cares Model Accessible Home encountered a number of general design considerations that are essential to accessibility, including the height and location of light switches, electrical outlets, phones and phone jacks, heating and cooling controls, toilets, sinks, countertops, and cabinets.

"To people with low strength and/or less control of their upper body, an inch here or there can make the difference between dependence and independence," says Geurink. Navigating doors and doorways, and opening and closing windows, are among the biggest challenges for people with limited mobility. The home's quality casement windows enable operation for a person with limited strength, and the dining room's bay window operates with a push-button, electronic opener.

Throughout the model home, longer-than-usual manual cranks make windows easier to open and close. Oversized lever locks are located near window bottoms, making them easier to use. For bay windows, locks were placed closer to the interior, giving ready access to people in wheelchairs. All window treatments were designed to be easy to manipulate as well.

Geurink notes that accessible windows aren't just about operability, but enjoyment, too. The windows have a maximum sill height of 33 inches, allowing viewing from a seated position. "Variety in window types is also important, which is why the home has some floor-to-ceiling windows. These allow for an unobstructed view, as well as letting lots of light in. The large southern exposure windows create a passive solar effect and make the rooms bright and sunny."

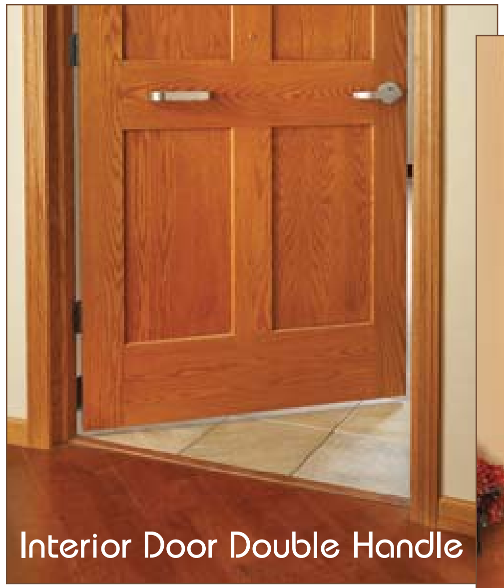
To make entry and exit easier, the home's exterior doors feature a flush-to-floor sill. Engineered into the doorframes as integral components, the sills ensure that the level of the finished floors align with the thresholds for wheelchair accessibility. People using crutches, canes, or walkers also benefit from the flush thresholds.

All of the exterior and interior doors are wider than usual (36 inches) to comfortably accommodate passage by people in wheelchairs. Interior swinging doors are fitted with lever handles, making them easier for people with limited dexterity to operate than doors with knobs or latch handles. The utility closet door is not only oversized, but it also has an additional pull bar mounted to its surface to make it easier to close.

Similarly, the home's closets feature double doors and bi-fold doors, making them easier to open and close for people with restricted mobility and diminished hand strength. Pocket doors provide unobstructed interior openings to a laundry room and bathroom. "The pocket doors are easy for people with low strength to open, and because they do not require any swing clearance, they stay completely out of the way, making them a great convenience for visually impaired people and for people in wheelchairs," explains Geurink.

The windows and exterior doors all feature energy-efficient LoE2-270 glass with double glazing and weather stripping to prevent draft and temperature variations. For minimal exterior maintenance, Kolbe Ultra Series windows are finished in Hartford Green 70 percent fluorpolymer and are trimmed in oak to match the interior doors' classic look.

The home illustrates that barrier elimination and a functional floor plan that eases everyday living are design essentials. "The home's two-story, 4,700-square-foot size might strike some as big, but each room needed to be large enough to accommodate group tours—and to demonstrate a five-foot turning radius for wheelchairs. Wheelchair turning radius needs to be taken into account on at least one side of the bed, alongside the toilet, in front of the bathroom sink, in the roll-in shower, between work areas in the kitchen, and in walk-in/roll-in closets. Having wider hallways for wheelchair transit is also critical," says Geurink.


Interior Door Double Handle

Sliding Door Sill Ramp

Bay Window Motor Option

An elevator provides second-floor access for people in wheelchairs and others with limited strength or mobility, and a stairway lift is also planned. Stairway steps have a contrasting color edge to help vision-impaired people see the edge of each step. Handrails on stairs and in the extra-wide, 48-inch hallways provide stability for people with limited mobility. To aid wheelchair passage, the home's carpeted rooms have low-nap carpeting.

The garage has several accessibility features, including parking spaces large enough to allow for driver-side loading and unloading of a wheelchair, and for a wheelchair lift on the passenger side or at the rear of the vehicle. Entering the house from the garage, visitors notice an oversized storm-safe room that comfortably fits wheelchairs. Nearby, the utility rooms' fuse box controls are located on the main living level of the home, and the furnace is easily accessible, allowing for a person in a wheelchair to replace the filter. A programmable thermostat provides energy efficiency and convenience.

When natural daylight from the home's many windows is not available, energy-efficient fluorescents illuminate the interior. All light switches feature rockers, making them easier for people with limited hand dexterity or coordination to operate. To make them easy to find, the home's light switches are located adjacent to doors, and are horizontally aligned with door handles.

Grab bars and non-slip shower and tub floors also are among the home's accessible features. "Common sense would suggest that any new or remodeled home would include these, because even the most able-bodied person can slip and fall. In fact, statistics show that slips and falls—especially while using the tub or shower—are among the most common household-related injuries, and can be serious or even deadly," says Geurink.

In the bathrooms, tilted mirrors over the bathroom sink accommodate people in a seated position. The faucets are motion-activated, and the medicine cabinets are mounted at counter height, allowing visibility and accessibility to their contents. Some of the home's faucets and shower controls feature anti-scald mechanisms that automatically mix water to a preset temperature.

The kitchen's accessibility elements include a sink with an open space beneath to accommodate a wheelchair and a motion-activated faucet. The under-counter dishwasher has front-mounted controls, and an open counter space on one side of the dishwasher enables easy access. The built-in oven has a side-hinged door, and all appliances are raised to permit easier wheelchair access. Several counters and cabinets are height-adjustable, and a 10 x 7-inch toe space allows for the front wheels and footrest of a wheelchair to clear the cabinets.

The living room serves as a large meeting room. The dining room also does double duty as a resource library and offers take-home information about the house. The home's ample size provides for a large display area for sight- and hearing-related equipment, makes it easier to handle group tours, as well as enables future growth flexibility. Geurink adds that the home's two-story floor plan accommodates many settings and features, which "can easily be changed or modified as accessibility related fixtures and equipment change over time."

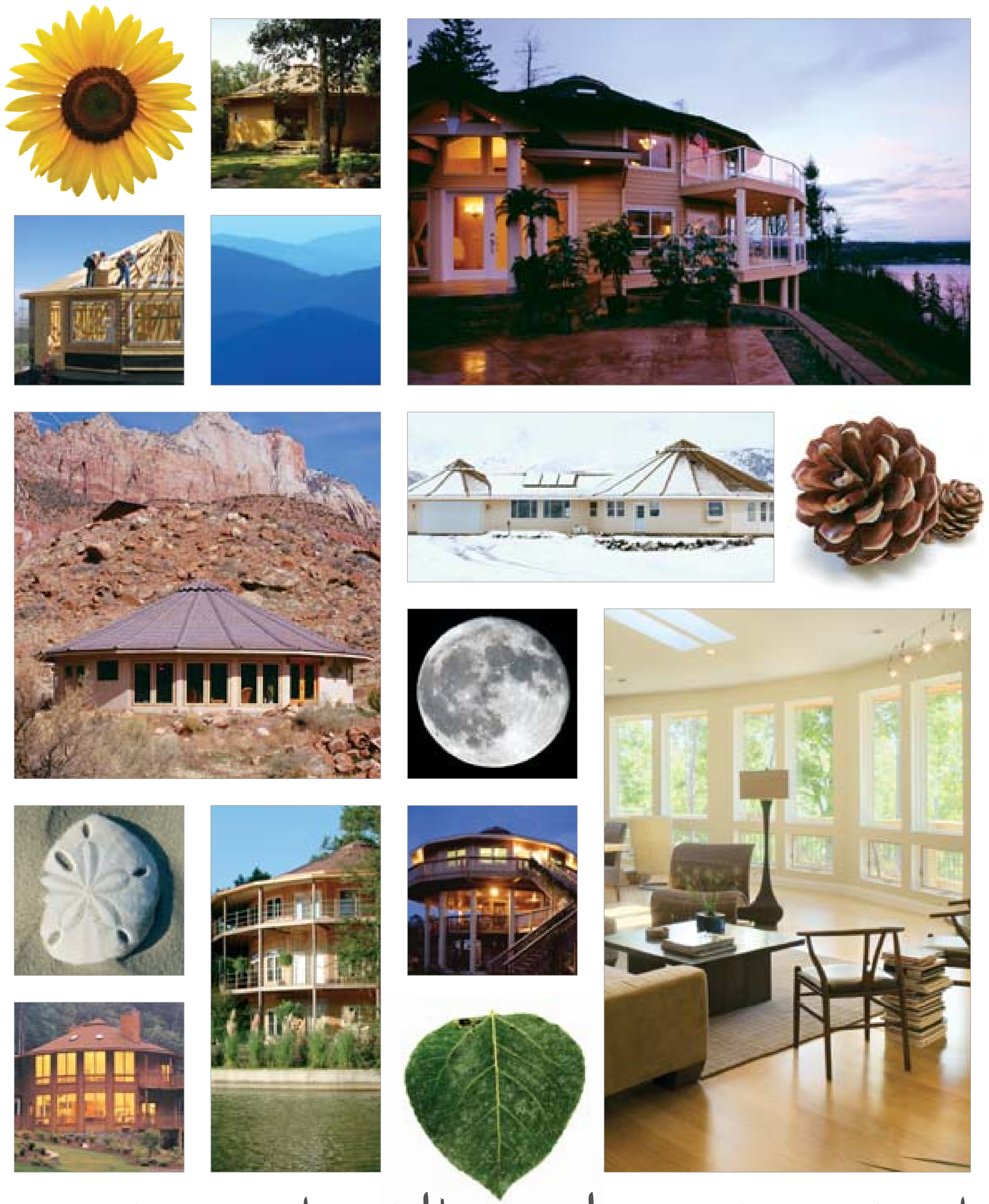
For more on Chairs and Cares, please visit www.choicesil.com.

To learn more about Kolbe products that contribute to independent living, visit www.kolbe-kolbe.com.

The Author

Heather West is a freelance writer and marketing consultant with 15 years of experience in architectural, building and construction products and services. She can be reached at heather-west@earthlink.net.

For more information on Kolbe's universal design products, visit www.kolbe-kolbe.com or call 800-955-8177.



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Universally Designed Proto-House: Lessons From Arkansas?

Korydon Smith, Jennifer Webb,
and Brent Williams

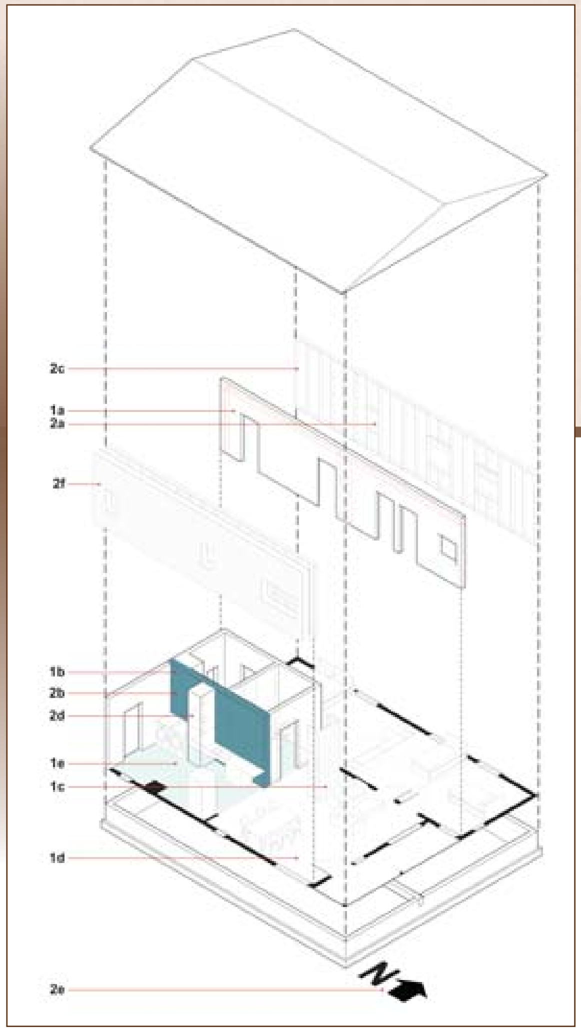

Figure 1. Principles of the AR Proto-House.

synopsis

- As housing production has slowed, health care costs have risen, and demographics make massive shifts, America confronts a tremendous question: How can housing (a) meet the variety of needs and preferences of [the] society, (b) ensure equity among the various groups that comprise that society, and (c) be created at low costs and high quality?
- The prototype sought to create "sense of home," of individuality, as well as adequately address local site constraints and a "sense of community."
- The Arkansas Proto-House is an exploration in meeting the physical and psycho-social housing needs of the state, and an analogue for solving parallel concerns across the U.S. For example, one of the greatest challenges to attainable affordable housing in areas experiencing economic and housing booms (e.g., Northwest Arkansas) is the rapid rise in land values.

There's a Southern accent
Where I come from.
The young'ns call it country,
The Yankees call it dumb.
I've got my own way of talkin'.
…I've got my own way of workin'
…I've got my own way of prayin'
…We have our own way of livin'
And everything is done
With a Southern accent
Where I come from.

- Johnny Cash, country singer and native Arkansan (excerpts from "Southern Accents," original lyrics by Tom Petty, native Floridian)

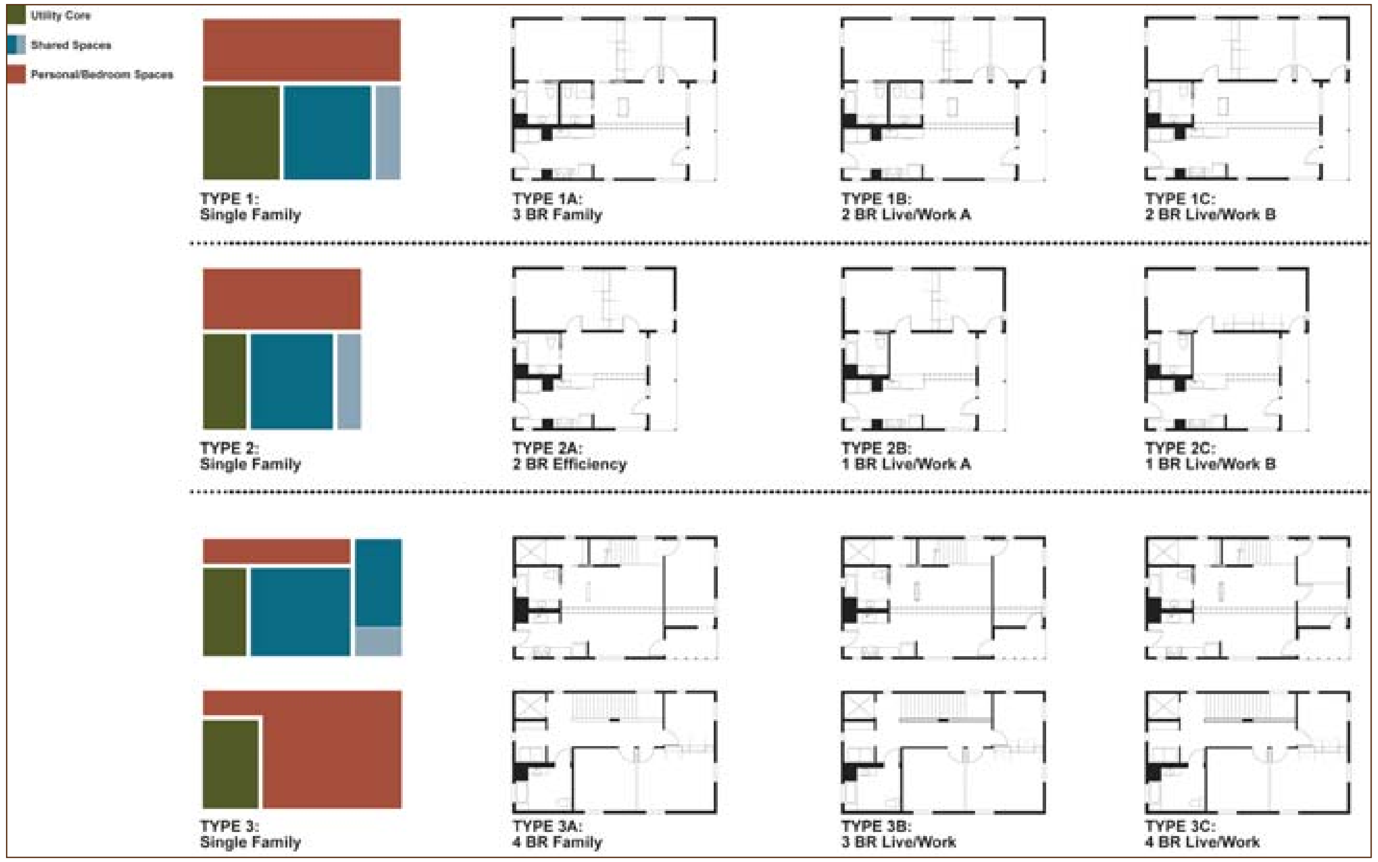

Figure 2. Types and Sub-types of the AR Proto-House.

The conceptualization of disability has shifted, and so too has design with the emergence of "universal design." We do not, however, need a new definition of disability to tell us that getting a wheelchair up steps is difficult. The problem of design rests not on theoretical notions of how we define disability, but on how to ensure that the widely diverse needs and preferences of all people are translated into "good design." Many lessons have been learned in recent years, as universal design concepts have proliferated worldwide. Arkansas, however, is an unlikely place to look for lessons in good design. In fact, it may be the last place Americans look for counsel about anything. Arkansas is more likely to be the punch line of any number of "trailer trash" jokes than an exemplar of good housing practices. But, as English Professor Fred Hobson states, "The South always makes good reading. It features the virtues and vices, writ large, of the nation as a whole."

Arkansas (and the South in general) has gained the status of dupe for numerous reasons. The South holds the highest rates of poverty and disability, lowest rates of higher education and employment, and highest percentage of rural inhabitants of any region in the U.S. According to the U.S. Census Bureau, Arkansas has the third highest disability rate, highest rate of poverty, highest rate of increase in poverty, seventh highest percentage of residents 60 and older, and the fifth highest percentage of Social Security/Disability recipients. Arkansas is the only state in the top seven in all categories. In addition, nearly one in three households in Arkansas has at least one household member with a disability. More importantly, Arkansas is a window to the future, a demographic exemplar of the U.S. in 2015, and serves as a testing ground for new and better housing. As the most sizeable cohort of America, the boomer generation, enters retirement, creative planning and housing schemes will need to emerge. The Arkansas (AR) Proto-House is one attempt to address the varied economic, sociological, environmental, and technological conditions of the South. The AR Proto-House tackles the major challenges of developing prototypes that are both replicable (standardized) and culture-/site-specific (customized) for underserved populations.

The Context Of The AR Proto-House

As housing production has slowed, health care costs have risen, and demographics make massive shifts, America confronts a tremendous question: How can housing (a) meet the variety of needs and preferences of [the] society, (b) ensure equity among the various groups that comprise that society,

Figure 3. Major Geographic Regions of Arkansas.

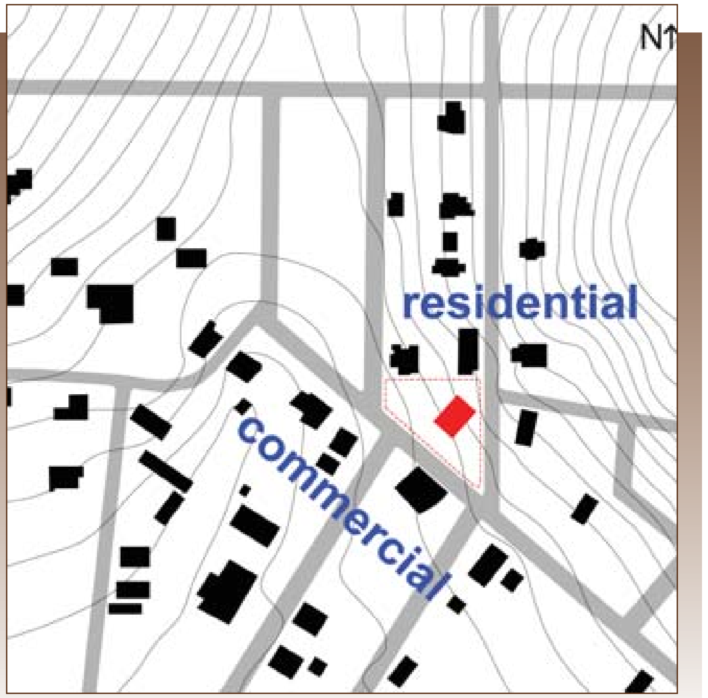

Figure 4. Context of the Ozark Prototype.

and (c) be created at low costs and high quality? Nowhere is this question more pertinent, timely, and challenging than in the South, a region characterized by strong contrasts in economic, racial, geographical, educational, and health statuses (not to mention the political mythology of the "segregated South"). In essence, the South is as diverse, if not more so, than any other subculture in the U.S. This is also true of the housing—both the aesthetics and the typologies—that exists throughout Arkansas and the South. The following question emerges: Can equity be achieved even with the disparities;

> The problem of design rests not on theoretical notions of how we define disability, but on how to ensure that the widely diverse needs and preferences of all people are translated into "good design."

can equitable housing and neighborhoods be developed despite local economic and sociological imbalances? This diversity is intensified as one looks deeper at the complex and often contradictory definition of "Southern culture." This definition was a popular topic among regional sociologists and geographers throughout the latter part of the 20th century, and it has long been debated. Does the South have its own unique identity or is this a mythic stereotyping of the region? Are characteristics associated with the South unique, or do other areas of the country possess "Southern" traits?

Researchers have examined factors stereotypically associated with the South: religious and political beliefs, attitudes toward guns and violence, family and social values, food, etc. Many findings countered previous assumptions about Southern culture. Several studies, for example, illustrated that "Southern identity" is deeper and more prevalent among more-affluent, higher-educated Southerners than among less-wealthy, less-educated Southerners. As James Cobb states of middle- and upper-income Southerners, there was a shared attitude: "Never miss an opportunity to host a brunch, and remember that a meal without cheese grits or broccoli casserole is like a liquor cabinet without Jack Daniels or Maker's Mark." This is in contrast to poor Southerners who, as research has shown, are much more in tune with their "poorness" than their "Southerness." In either case, housing plays a central role in developing a sense of identity, place, and culture.

Developing The AR Proto-House

Many factors influence the decisions people make about buying/renting a home, including location, cost, family structure/needs, and aesthetics. While the housing industry and

Figure 5. Perspective View of the Ozark Prototype.

popular culture tend to place emphasis on the fourth item—"looks"—the first three play a greater role in selecting a residence (e.g. proximity to work and/or school), especially among less-affluent rural Southerners. In any case, there is the necessity for diverse housing options; it is difficult to imagine a singular prototype that accommodates all family structures, physical and psychosocial needs, etc. Nonetheless, an economy of means, realized through standardization, is essential to providing quality, affordable housing; pure customization is not viable.

The AR Proto-House explored this paradox: the need for standardized housing design/construction and the necessity for variation. The prototype sought to create "sense of home," of individuality, as well as adequately address local site constraints and a "sense of community." The overarching goal was to address the duplicitous role of the "home"—a synthesis of diversity and equality, of both social and private needs. The development of the AR Proto-House addressed these challenges through four steps.

First, design criteria were developed by analyzing Arkansas' diverse geologic, environmental, cultural, and economic characteristics, as well as an understanding of the interrelationship of poverty and disability in the South [Figure 1]. Eleven major principles, under the auspices of two overarching concepts resulted:

1. Maximize Adaptability
    - a. minimize interior load-bearing walls
    - b. construct continuous structural surfaces in bathrooms/kitchens
    - c. utilize easily adapted cabinetry, fixtures, and furniture
    - d. utilize open-space planning/minimize space used exclusively as circulation
    - e. ensure ease of mobility, operability, perceptibility, and security for diverse users
2. Maximize Efficiency
    - a. utilize modular construction
    - b. cluster utilities together
    - c. size structural members for material efficiency
    - d. size HVAC systems for energy efficiency
    - e. site building for energy efficiency
    - f. utilize durable, low-maintenance materials and assemblies

Second, these design criteria led to a basic patterning of nine single-family prototypes [Figure 2]. This taxonomy included three major types: (1) a one-story family, (2) a one-story efficiency, and (3) a two-story family, and each major type included a range of three sub-types, including one "family option" and two "live/work options." The family options focused on sleeping and family gathering spaces, while the live/work options included a home office—for an accounting, consulting, or Internet business, for example—accessible from the main porch entry and able to be closed off to the rest of the home. In addition, each sub-type was designed to be easily transformed into another sub-type. For example, "Type 2A: 2BR Efficiency" can easily be modified to become "Type 2B: 1BR Live/Work A." This is achieved by replacing the bedroom window to the porch with a door. During the initial construction of the home, the bedroom window to the porch is framed like a door to facilitate future adaptation.

Third, the major site factors that influence housing design were identified and used to transform the generic types. Many factors influence design/construction and rental/purchasing decisions, but four primary issues associated with any given site tend to exert the greatest influence on single-family housing design. These site-specific factors include topography,

orientation to the street, bearing (orientation to the sun), and parking. The hierarchy of these issues may change greatly from one project to the next, as clients, sites, material costs, and other factors change. The tendency in many single-family developments and tract housing is to eliminate or ignore these features by flattening topography, ignoring the cardinal directions, and dogmatically repeating the housing across the landscape, resulting in increased site costs, increased heating/cooling costs, and decreased neighbor interaction. The AR Proto-House, on the other hand, was modified by these four factors. The approach, threshold space (e.g. porch), and interior organization of each prototype was transformed to create a better fit and increased usability.

Finally, specific site locations were selected as a means to explore and demonstrate how the generic Proto-House could be transformed and deployed in a site and culture-specific manner. In other words, how can diverse household structures (e.g. single-parent families, extended families, traditional families, etc.) as well as diverse sites (e.g. flat vs. sloping) be addressed while maintaining a certain degree of universality and cost effectiveness? Site specificity is important, as, according to John Reed,

Figure 6. Ground-level (Live/Work) Plan of the Ozark Prototype.

"Southerners seem to have retained a greater degree than other Americans of a localistic orientation—an attachment to their place and their people. Although there are some cracks in this pattern, localism can be expected to color the outlook of many Southerners for some time to come."

Arkansas, not unlike Tennessee, North Carolina, and others, possesses both naturally defined borders (such as the Mississippi River to the east) and surveyed borders (such as the northern border between Arkansas and Missouri). Although these borders define a political and legal territory, the sociological, economic, climatic, and topographic characteristics are not homogeneous throughout the state. This is true of most states. The eastern part of Arkansas—"The Delta" (the Mississippi Alluvial Plain)—maintains a much greater prevalence of poverty and disability than much of the rest of the state, is predominantly agricultural, and is prone to flood. The northwestern part of the state (the Ozark Plateau), on the other hand, is fairly mountainous and home to one of the ten fastest-growing economies in the country [Figure 3]. Nevertheless, neither of these regions is homogeneous; each region possesses pockets of poverty and wealth, etc.; each region possesses housing challenges.

To test the adaptability of Proto-House, a site was selected in Fayetteville, a diverse college town in the Ozark region of the state, which contained numerous challenges. The site had a triangular lot with two adjoining streets, was steeply sloping, and sat on the border between commercial and residential zoning [Figure 4]. This site, and the challenges it possessed, served as a case study to see how the AR Proto-House could be efficiently transformed. Type 1A (Family) and Type 1B (Live/Work) were utilized to create a stacked duplex. Duplex housing is prevalent in the area but typically possesses two major shortcomings. First, the duplex housing that occurs in Northwest Arkansas is often conceived as two independent houses "merged at the hip." Second, parking, approach, and privacy between the units is seldom well resolved. The Ozark case study, on the other hand, is conceived as a whole unit, and, from the street, looks like one large single-family home [Figure 5]. This strategy enables the residence to appear more substantial and helps to combat the "not in my back yard" attitude often confronted in affordable housing. In addition, the Ozark prototype has two "fronts"; the lower level faces a prominent main street, while the upper level faces a side street [Figures 6 and 7]. The lower-level, live/work unit, utilizes an on-site parking strategy, whereas the upper-level, family unit, takes advantage of on-street parking. The live/work unit faces the commercial zone, and the family unit faces the residential zone. Most importantly, both units are accessible at grade; both units contain kitchens, bathrooms, and living spaces that accommodate the needs of a wide range of families/individuals; and both units are designed to maximize material and environmental efficiencies.

Lessons Beyond Arkansas

By 2030, the number of people in the U.S. that are 65 and older will double, which will result in a large increase in the number of persons with disabilities. Developing housing that supports the needs of this population will be crucial, especially when considering that more than 80 percent of the (non-institutionalized) older adult population in the U.S. is living alone or with a spouse of similar age. As such, small-scale, universally designed living units will be significant in the future. For the South, despite the inefficiencies, this will likely come in the form of detached housing, as this type is currently the most dominant and most culturally accepted form of housing. Finding alternative—more efficient, more sustainable, more user-friendly—means of providing detached single-family housing is the focus of the Arkansas Proto-House.

Figure 7. Longitudinal Section of the Ozark Prototype.

Disability is both a cause and a consequence of poverty, and in Arkansas people with disabilities are amongst the poorest of the poor. Poverty is not simply the consequence of a lack of resources. Many people with disabilities are unable to access existing resources because of who they are or where they live. For people with disabilities, this discrimination is the primary cause of poverty.

Poverty and disability reinforce each other in a self-perpetuating cycle, contributing to increased exclusion and vulnerability. The result is that people who are poor have limited access to quality health care and are at greater risk of becoming disabled, and people with disabilities have limited participation in employment and are at great risk of becoming impoverished. While bad design is not responsible for disability or poverty, it can certainly exacerbate the disability-poverty syndrome.

Although the fundamental, universal characteristics of the South may not be fully knowable (and may not even exist), the mythology of the South makes it worth a deeper look. As Louis E. Swanson states,

"The current crisis in the rural South involves a considerable amount of human suffering. I do not use the term 'suffering' lightly. Suffering here refers to material, health, and spiritual hardships that a middle-class American would find unacceptable.[…] Much of rural America is mired in a crisis, which has the potential for approaching and even surpassing the relative suffering of the Great Depression. Moreover, the rural South has always [pers] existed on the periphery of U.S. society, is worse off than most other areas of rural America."

Public health is one of the primary dilemmas of the rural South and has been for decades. Arkansas is a lens to the future as baby boomers are entering retirement across the nation; and, if you can find strategies for solving the current housing dilemmas of Arkansas, you can solve the future housing dilemmas of the nation. The Arkansas Proto-House is an exploration in meeting the physical and psycho-social housing needs of the state, and an analogue for solving parallel concerns across the U.S. For example, one of the greatest challenges to attainable affordable housing in areas experiencing economic and housing booms (e.g., Northwest Arkansas) is the rapid rise in land values. Increased land costs push affordable housing to the outskirts of town, increasing the distance inhabitants must travel to access employment, education, health care, and amenities. The Ozark version of the AR Proto-House takes advantage of a site that is typically considered "un-buildable" due to slope and zoning—a site that is centrally located yet vacant—and illustrates how a "standardized" prototype can be deployed in a "custom" setting. The AR Proto-House seeks to work within the diverse social and physical contexts of the South without pandering to stereotypes. Its design features are not exclamatory. [; this is] By representing a central value of universal design, [or, quite] it is simply good design. UHD

The Authors

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Gold, Silver, And Bronze Universal Design Features In Houses

The Center for Universal Design,
College of Design,
North Carolina State University

Bronze	Silver	Gold
Entrance Decks Interior Circulation Bathrooms Kitchens Garages and Carports Switches and Controls	Entrance Interior Circulation Bathrooms Kitchens Garages and Carports Switches and Controls Laundry Storage Home Automation Light and Color Windows	Entrance Interior Circulation Bathrooms Kitchens Garages and Carports Laundry Storage Hardware Sliding Doors Windows

The original Center's Gold, Silver, and Bronze universal house feature list was created in 2001 by The Center for Universal Design to ease adoption for builders and developers. These characteristics are the elements, features, ideas, or concepts that contribute to, or can be components of, a universal house. This list is intended as a guide and represents those features, which would be most challenging to add to an existing home.

Some items on the list are finite recommendations, some are lists of options, and some are scope statements in regard to how many particular features must or should be included. The more universal features/elements that are included in a house, the higher the level that can be achieved, with Gold being the highest level. Gold and Silver levels are additive to the Bronze level: the Silver level has all the features of the Bronze level, plus those listed under the Silver level. The Gold level has all the features of the Bronze and Silver levels, plus those listed under the Gold level.

Remember, a key component of universal design is the market appeal of the home and the integration of universal features into the overall home scheme. Universal design becomes a virtually invisible element of a home when done well.

Bronze Level

Entrances

Stepless Entrances

- At least one stepless entrance is essential; if only one, not through a garage or from a patio or raised deck.
- Level bridges to uphill point.
- Drive and garage elevated to floor level, so vehicles do the climbing.
- Earth berm and bridge, and sloping walk details.
- Site grading and earth work (with foundation waterproofing) and sloping walks at 1 in 20 maximum slope.
- Avoid ramps. If ramps are used, integrate into the design.

Other Entrance Features

- One-half-inch maximum rise at entrance thresholds.
- Space at entry doors should be a minimum 5 feet x 5 feet level clear space inside and outside of entry door, for maneuvering while opening or closing door.
- Clear door opening width (34-inch minimum = 36-inch wide doors), for all entrance doorways.

Decks

- Build deck at same level as house floor.

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Interior Circulation

• At least one bedroom and accessible bathroom should be located on an accessible ground-floor entry level (same level as kitchen, living room, etc.).
• Clear door opening width (32-inch minimum, 34- to 36-inch wide doors), for all doorways.
• Clear floor space (18 inches minimum) beside door on pull side at latch jamb provides space to move out of the way of the door swing when pulling it open.
• Circulation route (42-inch minimum width) to provide maneuvering room in the hallways and archways.

Vertical Circulation

• Stair handrails placed on both sides of stairs.

Bathrooms

At least one bathroom on the accessible level must have one of the following accessible bathing fixtures:
• Minimum 5 foot x 3 foot (4 feet preferred) deep curbless shower.
• Adequate maneuvering space: 60-inch diameter turning space in the room and 30-inch x 48-inch clear floor spaces at each fixture. Spaces may overlap.
• Clear space (3 feet) in front and to one side of toilet allows for easy maneuvering to and around toilet.
• Toilet centered 18 inches from any side wall, cabinet, or tub.
• Broad blocking in walls around toilet, tub, and shower allows for future placement and relocation of grab bars while assuring adequate load-bearing and eliminates the need to open up wall to add blocking later.

Fixture Controls

• Single-lever water controls at all plumbing fixtures and faucets.
• Mix valve with pressure balancing and hot water limiter prevents scalding people who cannot move out of the way if water temperature and/or pressure changes suddenly.

Kitchens

• Space between face of cabinets and cabinets and walls should be 48 inches minimum.
• Full-extension, pull-out drawers, shelves, and racks in base cabinets for easy reach to all storage space.
• Adjustable height shelves in wall cabinets.
• Pantry storage with easy access pull-out and/or adjustable height shelves for easy reaching of otherwise hard-to-get items.
• Single-lever water controls at all plumbing fixtures and faucets.

Garages

• Power-operated overhead doors.

Switches And Controls

• Light switches above floor, 36 inches to 44 inches maximum, and thermostats at 48 inches maximum height.
• Electrical outlets, 18 inches minimum height, allow easy reach from a sitting position as well as for those who have trouble bending over.
• Electrical panel with top no more than 54 inches above floor located with a minimum 30-inch x 48-inch clear floor space in front.

Silver Level

Stepless Entrances

• More than one stepless entrance is preferred.

Garages And Carports

• Sloping garage floor (with through-the-wall vents at bottom of slope to release fumes, if a garage) in lieu of stepped entrance with ramp from garage to house interior in attached garages.

Other Entrance Features

• Weather-protection shelter while unlocking and opening doors, such as porches, stoop with roof, awnings, long roof overhangs, and/or carports.
• Use slatted decking for positive drainage (i.e., a wood trench drain).
• Light for operating at entry doors: focused light on lockset, general illumination for seeing visitors at night, and/or motion detector controls that turn on lights when someone approaches the door, thus eliminating the problem of dark approaches and adding a sense of security.

Interior Circulation

Vertical Circulation

If a two-story dwelling:
• At least one set of stacked closets, pantries, or storage spaces with knock-out floor for later use as an elevator shaft.

Bathrooms

At least one bathroom on the accessible level must have one of the following accessible bathing fixtures:

• Tub with integral seat, waterproof floor, and a floor drain.

Additional features for all bathrooms:
• Countertop lavatories preferred with bowl mounted as close to front edge as possible.
• Wall-hung lavatories acceptable with appropriate pipe protection.
• Pedestal lavatories are not acceptable.
• Long mirrors should be placed with bottom no more than 36 inches above finished floor and top at least 72 inches high. Full-length mirrors are good choices.
• Offset controls in tub/shower with adjacent clear floor space allows for easy access from outside the tub with no inconvenience when inside.
• Integral transfer seat in tub and in 3-foot x 3-foot shower stall allows people to sit in tub/shower without needing additional equipment.
• Grab bars, if installed, should not be stainless steel or chrome. Use colors to match decor.

Fixture Controls

• Handheld showerheads in all tubs and showers, in addition to fixed heads, if provided. Single-lever diverter valves if needed.
• Adjustable-height, movable, handheld showerhead or 60-inch flexible hose allows easy use by people of all heights.

Kitchens

• Contrasting color border treatment on countertops. Color or contrast difference allows easy recognition of the edges of counters and the different heights to prevent accidental spills.
• Stretches of continuous countertops for easy sliding of heavy items, particularly between refrigerator, sink, and stove top, for easy one-level food flow.
• Front-mounted controls on appliances to facilitate easy reach.
• Cooktop with knee space below allows someone to use the appliance from a seated position. May be open knee space or achieved by means of removable base cabinets or fold-back or self-storing doors. Pipe-protection panels must be provided to prevent contact with hot or abrasive surfaces.
• Cooktop or range with staggered burners and front- or side-mounted controls to eliminate dangerous reaching over hot burners.
• Glare-free task lighting to illuminate work areas without too much reflectivity.
• Side-by-side refrigerator allows easy reach of otherwise hard-to-get items, particularly if pull-out shelving is provided. Or:
• Use under-counter or drawer-type refrigerators and install them on raised platforms for optimum access to storage space of 18 inches to 48 inches above finished floor.

Laundry Areas

• Front-loading washers and dryers, with front controls, raised on platforms to reduce the need to bend, stoop, or lean over.
• Clear space 36 inches wide across full width in front of washer and dryer and extending at least 18 inches beyond right and left sides. (Extended space can be part of knee space under countertops, sink, etc.)

Storage

• 50 percent of storage to be no more than 54 inches high.
• Adjustable-height closet rods and shelves allow for flexibility of storage options.

Garages And Carports

• Extra length and width inside for circulation around parked cars.
• No ramps in garages.
• Sloping garage floor (with through-the-wall vents at bottom of slope to release fumes) in lieu of stepped entrance with ramp from garage to house interior.

Home Automation

• Motion-detector light switches in garages, utility spaces, entrances, and basements.
• Remote controls for selected lights.
• Remote controls for heating and cooling.
• Doorbell intercoms that connect to portable telephones.
• Audible and visual alarms for doorbell, baby monitor, smoke detectors, etc.

Light And Color

• Color contrast between floor surfaces and trim allows easy recognition of the junction of floor surfaces and walls. Avoid glossy surfaces.
• Color contrast difference between treads and risers on stairs.
• Ambient and focused lighting allows lots of light. Lighting that is thoughtful and variable, emphasizing lighting at stairs, entrances, and task lighting.

• Contrast between countertops and front edges or cabinet faces.

Switches And Controls

• Easy-touch rocker or hands-free switches. (See Home Automation.)

• Additional electrical outlets at bed locations and desk for equipment, four-plex boxes each side for computer and electronic equipment as well as for personal use equipment.

Windows

• Windows for viewing, 36-inch maximum sill height. Casements, awnings, hoppers, and jalousies are good choices but are not essential.

Gold Level

Stepless Entrances

• Make all home entrances stepless.

Other Entrance Features

• View of callers for all people, including children and seated users, through sidelights, wide-angle viewers, TV monitors, windows in doors, and/or windows.

• A place to put packages while opening doors: built-in shelf, bench, or table with knee space below located on the outside next to the door.

• A way for visitors to communicate with residents, such as lighted doorbell at a reachable height, intercom with portable telephone link, and/or hardwired intercom.

• Address/house number should be large, high contrast, located in a prominent place, easy for friends and emergency personnel to locate.

Interior Circulation

• Turning space in all rooms (5-foot diameter).

• An open plan design, minimizing hallways and doorways and maximizing sight lines.

• Floor finishes that minimize glare, are slip resistant, and offer low resistance to walking or rolling.

Vertical Circulation

• All stairs to have appropriate width and space at the bottom for later installation of a platform lift, if needed.

Bathrooms

Bathrooms on the second floor should follow guidelines.

At least one bathroom must have one of the following accessible bathing fixtures:

• Tub with integral seat, waterproof floor, and a floor drain.

• Other bathrooms in the same house may have a tub with an integral seat or a 3-foot x 3-foot transfer shower with L-shaped folding seat and one-half-inch maximum lip (curb) in lieu of fixtures described above. When more than one bathroom has the same type of bathing fixture (a tub, shower, wet area shower), at least one shower should be arranged for left-hand use and one for right.

• Knee space under lavatory (29 inches high) allows someone to use lavatory from a seated position. May be open knee space or achieved by means of removable vanity or fold-back or self-storing doors. Pipe-protection panels must be provided to prevent contact with hot or sharp surfaces.

Kitchens

• Clear knee space under sink (29 inches high minimum) allows someone to use the sink from a seated position. May be open knee space or achieved by means of removable base cabinets or fold-back, bifold (Door Ease), or self-storing doors. Pipe-protection panels must be provided to prevent contact with hot or sharp surfaces.

• Adjustable height work surfaces (28 inches to 42 inches), electrically powered, continuously adjustable counter segments, some with cooktops and/or sinks and disposal units (e.g. Adjustable Systems, Inc.) Or:

• Mechanically adjustable counter segments, some with sinks and disposal units, some with cooktops, adjustable in 2-inch increments (28 inches to 42 inches) allows in-kitchen work for people of all heights, those with back trouble, people who are seated, and/or children.

• Built-in oven with knee space beside, set for one pull-out oven rack at the same height as adjacent countertop.

• Drop-in range with knee space beside, top set at 34 inches above finished floor.

• Dishwasher raised on a platform or drawer unit, so top rack is level with adjacent counter top, puts bottom racks within easy reach, requiring less bending.

Laundry Areas

• Laundry sink and countertop surface no more than 34 inches above finished floor with knee space below.

Storage

• Motorized cabinets that raise and lower.

• Power-operated clothing carousels.

Garages And Carports

• Door height and headroom clearances (8 feet minimum) for tall vehicles or provide alternative on-site outdoor parking space.

Hardware

• Easy to use, requiring little or no strength and flexibility:

lever door handles

Push plates

Loop handle pulls on drawers. and cabinet doors—no knobs

Touch latches.

Magnetic latches in lieu of mechanical, keyless locks.

Windows

• Crank-operated windows.

• Power operators, whenever possible.

Sliding Doors

• Exterior sliding doors: Drop frame and threshold into subfloor to reduce upstanding threshold track, or ramp the finished flooring to top of track on both sides.

• Interior pocket doors: When fully open, door should extend 2 inches minimum outside door jamb and be equipped with open-loop handles for easy gripping.

• Bypassing closet doors—each panel should create an opening at least 32 inches clear. UHD

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Is There An Optimum Approach To Incorporate Universal Design Principles *When Designing A Home?*

Walton D. Dutcher, Jr.

As a designer and a person who uses a wheelchair, my first priority is Principle One: Equitable Use—the design is useful and marketable to people with diverse abilities.

This premise comes from the logic that unless you can get into the home, traverse through it, and have sufficient maneuvering space in each room or area, then everything that follows is meaningless. I feel that this approach allows the adaptation of the home to any circumstance without the alteration of the structure. It does not mean that the home is being designed specifically for an individual with a disability because Universal Design and "Barrier Free" or "Accessibility" are not the same.

Universal design is not a prescriptive set of features but rather a set of seven "principles" that, according to the North Carolina State University Center for Universal Design, serves to result in: "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."

Who then is the arbiter of what universal design is or is not? The answer is that there is no organization or group of individuals who dictate or certify whether a home can carry the title or imprimatur of being universal design. Even if there were a set of standard features, would the home buyer see value in them?

That being said, let's first examine what features might be incorporated using the Principles of Universal Design without significantly increasing the cost of a home or impacting the esthetics.

PRINCIPLE ONE: Equitable Use

"The design is useful and marketable to people with diverse abilities."

The key is "diverse abilities." In my opinion, this means that a home must either be basically useable by all or be able to be adaptable to accommodate the specific needs of an individual without incurring significant cost or modifying structural elements. My approach was to establish a basic set of features under the term "Life Span Design." Is it marketable? This requires a comparison of the cost features in the home versus those in the same target market. What else should be considered in designing a marketable home. The following information should be considered in differentiating the universal design home design from the other "me too" production builders. An article in the August 27, 2007 edition of the Blue Ridge Business Journal "Women In Charge," by Michelle Long, stated that: "Women make 80 to 85 percent of the buying decisions for families, represent roughly half of the population, and comprise nearly half of the working population." Given the significance of this statistic, the designer should be aware of what features are priorities of women. In the "Home & Garden" section of the September 8, 2007 edition of *The News & Observer*, in an article entitled "What Women Want In A House," by Marni Jameson, the following items were listed:

- Bigger kitchens
- More bathrooms
- Closets, closets, and more closets
- Smaller living room

While these design features are important marketing considerations, they aren't actually considerations under Principle One because one cannot separate "marketable" from "people with diverse abilities." Therefore, in order to develop an "optimum approach" to designing a universal design home, the builder and designer need to establish a logical system that will result in a set of features for each principle. The critical consideration is if any feature will impact the cost and esthetics of the home, which would negatively influence the marketability.

Life Span Design Features

- A 4-foot wide walkway from sidewalk or driveway
- No-step entries
- ADAAG-compliant thresholds
- 36-inch wide doors throughout

- Minimum 44-inch wide hallways
- Accessible traffic pattern to all rooms and activity areas
- Electrical outlets and telephone jacks 18 inches from floor
- Switches 42 inches from floor
- Environmental controls 48 inches from floor
- Access to circuit breaker panel. Topmost breaker at maximum reach of 48 inches

PRINCIPLE TWO: Flexibility In Use

"The design accommodates a wide range of individual preferences and abilities."

Life Span Design Features

- Blocking for grab bar and shower-seat installations
- Roll-in showers offering adequate maneuvering room for wheelchairs
- Shower system including temperature set/pressure balance single-handle control, diverter valve, and handheld shower
- Side and front transfer access space to commodes
- Single-lever kitchen and bathroom sink faucets
- Adaptable bathroom vanities with separate sub-base that can be removed for clear access underneath
- Telephone jacks placed for convenience and ease of access
- CAT 5e/6 wiring to provide for technology requirements
- Wiring available for future outlet at top of hinge side of exterior front, and interior garage entry for installation of door operator

PRINCIPLE THREE: Simple And Intuitive Use

"Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level."

Life Span Design Features

- Thermostat with intuitive features and directive notations or symbols large enough to read and with sufficient color contrast

PRINCIPLE FOUR: Perceptible Information

"The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities."

Life Span Design Features

- Contrasting colors of floor materials delineating traffic passages.
- Energy-saving illumination with the following levels of minimum foot-candles (fc) for specific areas:

  Task surfaces: 50fc
  Passageways: 15fc
  Kitchen (counter, sink, range): 30fc
  Bathrooms at vanity tops: 30fc
  Showers and bathtubs: 15fc
- Various floor materials, all of which comply with the Federal Housing Accessibility Design Guidelines, and colors to differentiate areas

PRINCIPLE FIVE: Tolerance For Error

"The design minimizes hazards and the adverse consequences of accidental or unintended actions."

Life Span Design Features

- Low/no Volatile Organic Compound (VOC) materials and finishes
- Fire extinguisher mounted on base cabinet wall next to range/cooktop

PRINCIPLE SIX: Low Physical Effort

"The design can be used efficiently and comfortably and with a minimum of fatigue."

Life Span Design Features

- Lever handles on all swinging doors
- Handles that accommodate grasp on all sliding or bifold doors
- Kitchen, bathroom, and other cabinet doors fitted with D-shape or other style of handle that facilitates grasp and are ergonomic
- Garage door opener

PRINCIPLE SEVEN: Size And Space For Approach And Use

"Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of user's body size, posture, or mobility."

Life Span Design Features

- 60-inch turning radius in bathrooms and kitchen
- Lazy Susan corner cabinets in kitchen where indicated
- Pullout shelves in kitchen base cabinets

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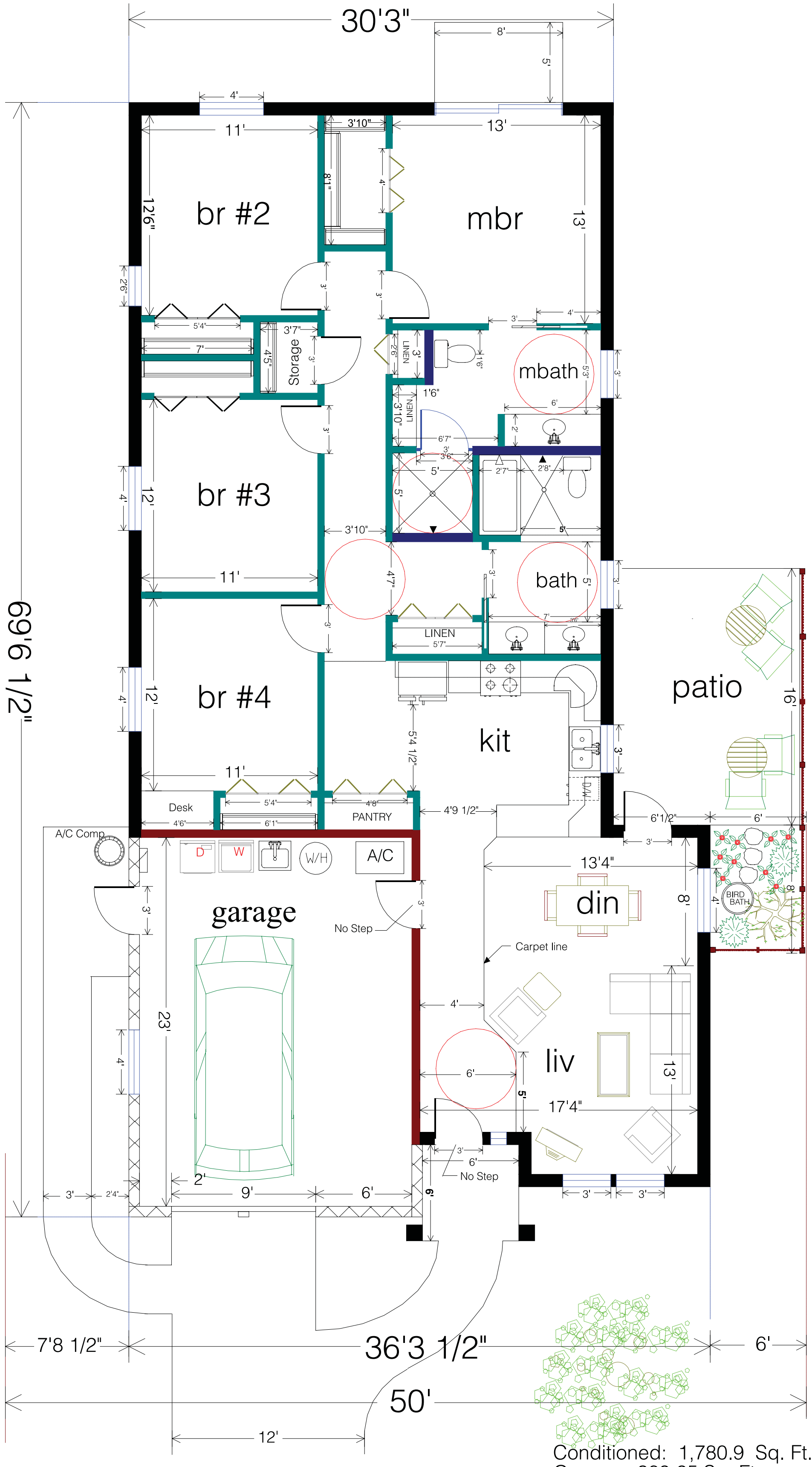
[1] Copyright 1997 NC State University, The Center for Universal Design http://www.design.ncsu.edu/cud/about_ud/udprincipleshtmlformat.html#top
[2] Ibid.
[3] Americans with Disabilities Act Accessibility Guidelines
[4] Copyright 1997 NC State University, The Center for Universal Design
[5-9] Ibid.



Prototype 4 Bedroom, 2 Bath Design
A custom design by Walton Dutcher

Conditioned: 1,780.9 Sq. Ft.
Garage: 389.25 Sq. Ft.
Porch: 42 Sq. Ft.

- Front control electric range
- Switches for disposal installed in the front apron of the sink base and range/cooktop exhaust fan/light switch installed in the base cabinet next to the range

In reviewing the Life Span features listed above, ask yourself: Do any of these mean that the home is intended solely for a wheelchair user? For instance, no-step entries mean that a baby carriage does not require lifting. It also eliminates a liability related from falling. Traffic pattern and maneuverability could mean that there may be more space, especially in the smaller "affordable" homes, and thus be the single most element that may add cost to a home. The only way you can achieve equitable use is if you can get to it. This does have a beneficial side, even if you don't use a mobility device. For instance, it gives you more space to move furniture, and if someone needs an ambulance to go to the hospital, then EMS can get a stretcher into the home without having to lift it up the steps, as well as maneuver through the home.

I realize that this design needs to be explained. The intent was to be marketed to the "affordable" population segment as well as being able to place it on a typical urban lot. There are no steps to get into the home. There is a good traffic pattern. The bathrooms and kitchen offer maneuvering space. Door swings or openings allow maneuvering. The hall bath incorporates a "wet room" design. This means that a family with children can still have a tub, but the space between the tub and the toilet can be used as a roll-in shower because there is a floor drain. That same space can be used for a side transfer from a mobility device to the toilet. Access to closets is sufficient. Other details such as outlets, switches, and such are not noted because they have no effect on access, traffic pattern, and maneuvering. In other words, it meets the basic elements of Life Span Design and Universal Design Principles. The red circles you see in the drawing depict a 5-foot turning radius.

There are some good and sufficient reasons to think beyond the optimum approach to incorporating Universal Design Principles in designing that I feel are worthy of note.

- The aging of the population.
- The expansion of the population.
- The advancement of medical technology increasing the capability of recovery following traumatic injury or disease, which also increases the potential for disabilities.
- The federal budget issues in addressing the deficit forcing either a tax increase, which is unlikely, or the diminishment in social services and health care, plus legislation advancing community-based services and supports.
- Potential for increase in the rate of disabilities based on obesity, the nation's number one health care issue, and low-birth-weight infants.
- Parents living with their children because of the cost of alternative housing or long-term care facilities.

I consistently see two-story homes being marketed to the "Active Adult," 55+, and Baby Boomers with no provision for future vertical access. I also see bathrooms, other than the master bath, defined by the width of a 5-foot tub. As a Medicaid Waiver provider doing home-accessibility assessments, I am constantly challenged to figure out a way to create an accessible bathroom within the small confines of these bathrooms. These and other modifications are paid for by your tax dollars, as attested to a study that showed that 87 percent of modifications to achieve accessibility in homes were funded by sources other than the homeowner. This cost, to say nothing of the inconvenience and dust that must be suffered by the homeowner, could be totally avoided if all housing incorporated Life Span design features that allow a home to be adapted to any circumstance, whether it be temporary or permanent, that may arise during one's lifetime. A home having these features also expands the market for resale.

The Author

Walton D. Dutcher, Jr. is a quadriplegic, the result of a spinal cord injury in May, 1956 while serving in the Navy. His educational background includes the study of Architecture at the University of Illinois, a graduate of the Milwaukee School of Broadcasting, an AA degree from St. Petersburg College, and a BA in Business Administration from the University of South Florida. His passion is architectural design. He has designed and built three of his own homes and designed a number of others for individuals throughout the U.S. He does home modification assessments as a Medicaid Waiver provider and also consults with architects, builders and developers. Mr. Dutcher can be reached at wdutche1@tampabay.rr.com.

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